BREAKING NEW GROUND:
TEACHING SKILLS OF INTELLIGENCE

Lethbridge Catholic Separate School District No. 9

Alberta Education

Alberta
EDUCATION

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BREAKING NEW GROUND: SKILLS OF INTELLIGENCE

Lethbridge Catholic Separate School District No.9

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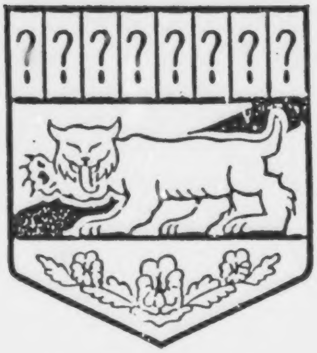

Shield of Inquiry

The Shield of Inquiry on the title page and depicted here expresses in classical form, some aspects of questioning and helps fix them in our minds and those of our children. The **eight question marks**, across the upper third of the crest, represent the well-known six questions, i.e., who, what, where, when, why, how, as well as two new creations, i.e., what next ("whext") and what if ("whif").

The **Lynx canadensis** in the middle of the shield has a proper stance for questions. Heraldic people call this the gardant position. Like any good questioner, this cat looks directly into the world with an unflinching gaze, ready to examine any proposition with a well placed enquiry. The right paw, cocked in its equivocal way, will knock the answer away if it does not suit; otherwise the paw will move tenderly, embracing the answer.

The **pansies** in the lower third stand for thought, that stirring in the brain that raises questions. Only the diagonal remains. What does it mean? Why include it? Therein lies the whole point of the shield!

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Foreword

This Thinking Skills Project in the Lethbridge Catholic Separate School District No.9 and in Red Deer Catholic School District No.17 relates to a priority of Alberta Education.

For some years now, various publications of Alberta Education have alluded to the desirability of teaching thinking skills to students. In one way or another, curriculum guides for mathematics, social studies, science, health and the recently developed CALM (Career and Life Management) call for the teaching of thinking skills. The Goals of Schooling and the Goals of Education would have the schools teach thinking skills. The achievement tests at grade three, six, and nine, and the diploma examinations at grade twelve contain questions which aim at challenging the disposition of students to think. Alberta Education has established a Committee on Thinking Skills charged with the responsibility to develop a Thinking Skills Framework for use in all curricular areas. This Committee has produced a "Framework for Thinking Skills", which includes a listing of over 130 skills.

The investigators in this study, believe they perceive the nature of the concern which Alberta Education has. The words, "Thinking Skills" pepper the documents of Alberta Education, and indeed, much current educational literature, but classroom practice appears to lag. This study revealed some possible reasons for this lag: a lack of conceptual structures; teachers' mistrust of the knowledge they possess; easy assumptions about the nature of the act of questioning; difficulty the teacher has in handling mistakes made by students in the learning process.

The Thinking Skills Project yielded, as one of its major findings, a cognitive model which provides for the integration of two modes of thinking as a way of handling knowledge and its uncertainties in a changing world.

The Thinking Skills Project aimed at identifying ways of developing teacher awareness of the worth of teaching the skills of thinking to children.

The study extended over the two school years from September 1985 to June of 1987. The research design included two comparison groups - teachers and students from Lethbridge Catholic Separate School District No.9 and like groups from Red Deer Catholic Separate School District No.17.

This project was funded through a research grant from the Planning and Research Branch of Alberta Education.

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ABSTRACT

The study had three specific purposes:

1. To provide teachers and students with a set of thinking skills;
2. To develop and validate a model of cognition for teachers; and
3. To devise a Measure of Questioning Skills and establish a normative base for this instrument.

The research used an experimental design supplemented by collection and analyses of subjective data.

The objective results demonstrated little effect. However, the subjective data indicates discernible growth in the acquisition of thinking skills by students and evidence of the teaching of thinking skills by teachers.

A validated model of cognition for teachers is presented. The development of a Measure of Questioning Skills and User's Guide is found in the report.

The report contains recommendations for followup.

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CHAPTER ONE

Introduction and Purpose to the Project

Perhaps schools stand on the fringe of something which will change them; or perhaps, as the nay-sayers would have it, the sounds we hear come from false trumpets on yet another band wagon: **thinking skills**. The thought of a band wagon intimidates. Indeed the current scene has many of the usual signs: bright, energetic advocates speaking at teachers' conventions or making attractive presentations at teachers' in-services, leaving the audience stimulated, but often feeling somewhat inadequate; or educational journals printing another article on thinking skills.

Learning and thinking skills form the heart of a school's program. What is the learning process and what are the basic thinking skills?

According to Millar (1975) learning takes place only when there is some interaction between the child and the environment. Learning is a conscious process. The result of learning can be observed, measured, and described. It implies a change in behaviour. The ability to learn depends upon and is modified by three essential factors: motivation, capacity, and persistence (Blatz, 1944). Simply, a child will learn when he wants to, when he is capable, and if he puts forth effort.

Motivation is provided by the teacher and the children. Children will learn when they are placed in an environment rich in ideas and materials. A teacher who can provide this environment is said to be inspirational. However, the choice (decision) whether the children will learn or not learn is left to them. They must make that decision and accept the consequences. Blatz coined the phrase, "You can lead youth to culture, but you can't make him think."

The fact that children vary in capacity (intelligence and personality) is well recognized by parents and educators today. Teachers and parents are encouraged to consider variation among children and to encourage each child according to their capacity.

Persistence or expended effort is dependent upon the meaningfulness of the goal. If children see no reason or sense in learning, then all teaching is futile. However, a good attitude for learning is the key to efficient and effective learning. Effort should not be directed toward some reward or goal, such as a prestigious award, or some material "bait."

The three conditions of learning, i.e., motivation, capacity, and persistence, are fundamental to the development of security. If the children are willing to accept the consequences of their actions and decisions, they are secure. The conscious correlate of this state is serenity. However, if the children are not willing to accept the consequences of their actions and decisions, they are insecure. The conscious correlate of this state is anxiety. Hence, learning develops a pattern in children of making decisions and accepting their consequences. Learning is a conscious process.

Thinking skills are basic cognitive processes or tactics that are considered to be more or less 'muscles of the mind' that can be strengthened through use. Examples of cognitive processess or tactics are comparison, order, classification, inference, evaluation and prediction. These are strategies for effective learning.

A model of essential thinking skills has been designed by Presseisen (1987). See Figure 1.

Figure 1 - A Model of Essential Thinking Skills: Basic Processes

QUALIFICATION - finding unique characteristics
units or basic identity:
definitions: specific facts:
problem/task recognition

CLASSIFICATION - determining common qualities
similarities and differences: correspondence:
grouping and sorting: comparisons:
either/or distinctions:
typologies

RELATIONSHIPS - detecting regular operations
parts and wholes: numerical progressions: patterns: sequences and order: hierarchy: prioritization: logical deductions: generalizations

TRANSFORMATIONS - relating known to unknown: creating new meanings
analogies:
metaphors: idioms:
logical inductions: translations:
applications: hypotheses

CAUSATION - establishing cause and effect, interpretation: predictions: forecasting
inferences:
judgments:
evaluations: assessments:

Increasing Complexity and Abstractness ↓

Such thinking skills have wide application and are assumed to be essential in the performance of many intellectual tasks. Thinking skills programs that purport to teach cognitive processing include Feuerstein's Instrumental Enrichment (1980) and deBono's CoRt Program (1983).

1.1. Teaching Thinking Skills in Isolation

Numerous researchers and teachers believe that thinking skills can and should be the focus of special exercises, texts, and programs. Lochhead (1972) and Bossone (1983) speak of the need "to isolate specific cognitive skills and to design instructional material appropriate for each skill." deBono (1983) claims that "generalizable thinking skills" can and should be taught, in addition to "local skills" required in particular subject matter areas. Bereiter (1984) indicates that teaching thinking as "enrichment" or as subject matter is unlikely to work. Thinking skills taught in isolation are viewed as "add on" and not integral to the curriculum or to academic substance. The significant act of transferring the thinking skills to content is missing or left to happenstance.

1.2. Teaching Thinking Skills in Each Subject Area

Ideally, training in thinking processes would be woven into subject area study. Two decades ago, much attention was given to Bruner's idea (1960) that the concepts central to each discipline can be taught through the discovery method. In recent years, specialists in mathematics, visual arts, music, and other subjects have claimed that unique aspects of their disciplines involve distinctive mental skills, requiring specially tailored strategies for learning.

While some subject-specific thinking skills undoubtedly exist, it is also clear that numerous cognitive skills cut across several school subjects. In both history and literature, students must be able to infer motivation, understand sequences, and trace cause/effect relationships. Skills in estimation, measurement, and visual imagery are essential to woodworking and geometry alike. All subjects involve definitions that in turn include classification and specification, comparison and contrast. No discipline can claim exemption from many of the mental processes that the advocates of isolated instruction in thinking skills see as generic.

1.3. Intelligence: Stable or Dynamic

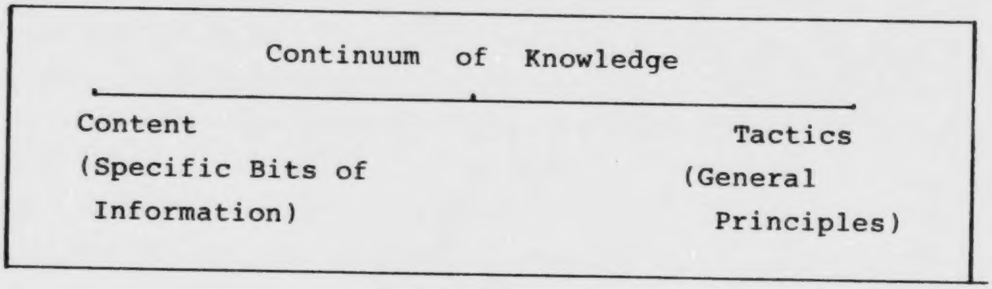
There are two opposing notions of intelligence. One school of thought (Binet - 1905, and Wechsler - 1955) believes that the limits of intelligence are established at birth and environmental experiences during an individual's life do little to change it. The other way of thinking about intelligence (Steinberg - 1981; and Feuerstein - 1980) is that it is modifiable and develops incrementally during an individual's life span.

Perkins (1986) clarifies the complex nature of intelligence with this simple equation:

$$\boxed{\text{Intelligence} = \text{Power} + \text{Tactics} + \text{Content}}$$

Power deals with the aspects of motivation and persistence. It does not lend itself to much improvement through instruction. But on the plus side, as the equation indicates, intelligence involves a lot more than power. Perhaps, we can improve thinking by teaching content. But we already try to teach considerable content in schools, with dissatisfying results. Indeed some would say that we teach too much content. This leaves the development of students' tactical repertoires as the natural window of opportunity for the improvement of thinking.

What is the difference between tactics and content? Indeed, no hard line separates the two. Rather, we do best to imagine a continuum. At the tactical end are very general principles that apply to many domains. At the content end are very specific bits of knowledge related to a particular subject, such as the date (Fort) Edmonton was founded or the multiplication table. In the middle appears knowledge of intermediate generality-tactics for solving mathematical problems for instance. Developing student tactics or thinking skills simply means paying much more heed to the middle and tactical end of the continuum than we usually do.



The investigators view **intelligence** as **developmental, modifiable** and **dynamic** in nature. As will be seen, later discussion elaborates this notion. Thinking skills were integrated with all subject areas of the curriculum and were expected to be used in the teaching of all subjects. The stance of the investigators is that thinking skills or tactics are most effectively taught in conjunction with appropriate content and should "crisscross" the curriculum.

1.4. **Inservice: Delivery of Tactics or Thinking Skills**

According to Joyce and Showers (1984) teachers unaccustomed to teaching for thinking need to study various thinking skills approaches: see them demonstrated; practice them; and even use them in classrooms and learning laboratories many times before becoming fully comfortable with them. Joyce et. al go on to say that about ten days of training are necessary to reach the initial stages of mastery of thinking skill approaches, and then it has to be practiced a dozen or more times before it becomes part of the natural repertoire. Each teacher needs to master several thinking skills before implementing those thinking skills in any given curriculum area. Thus, a school jurisdiction needs to invest in substanial opportunities for staff members to learn them.

This project aimed at providing professional development activities, in the words of Joyce and Showers, to "teachers unaccustomed to teaching for thinking."

1.5. Alberta Education Initiatives Related to Teaching of Thinking Skills

Three initiatives by Alberta Education relate to the importance of including thinking skills as a part of every subject area. These initiatives are discussed below.

1. Committee on Thinking Skills

The policy statement, Secondary Education in Alberta (1985) outlines the goals for secondary education in Alberta. The goals statements support the development of students' ability to think conceptually, critically and creatively. To facilitate the inclusion of thinking skills in the curricular revision process, an ad-hoc Committee on Thinking Skills (1987) has been established. The mandate of this committee is to establish a general framework for thinking skills which would be appropriate to all subject areas. The Framework for Thinkings Skills is intended to guide curriculum developers in the revision process and eventually will become a frame of reference for all curriculum development. It is anticipated that a document will be prepared for use by teachers in school so that the inclusion of thinking skills can become integral to all subject areas. One application of a document on thinking skills would be to assist teachers to reorganize generic skills that are common to various subject areas. For examples, the thinking skills of observing, questioning, measuring, recalling, predicting, and evaluating have direct application in the subjects of science, mathematics, health, and physical education.

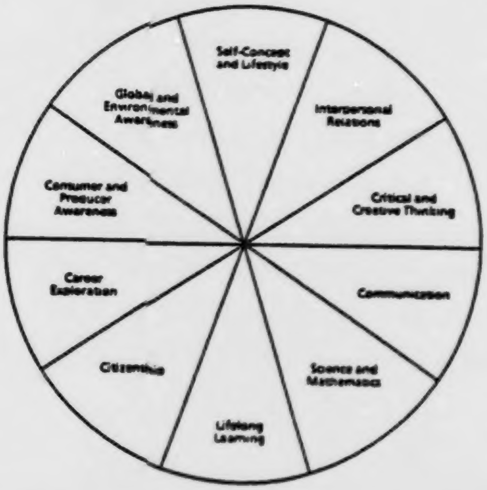
2. Essential Concepts, Skills and Attitudes for Grade 12.

Alberta Education has developed a catalogue of ten areas or groups of essential concepts, skills and attitudes which will help set priorities for the total provincial curriculum and can be used to interrelate subject areas meaningfully. For example, creative thinking is an essential skill that permeates all school subjects.

The circle graph below illustrates the areas or groups considered by Alberta Education to be essential in the education of an Alberta high school graduate. Curricular goals must consider these essential concepts, skills and attitudes in its development and, ultimately, its delivery in provincial schools.

The importance of teaching thinking skills is embedded throughout the skill component of each area. The circle graph does not intend to indicate relative importance of any of the areas.

AREAS OF ESSENTIAL CONCEPTS, SKILLS, AND ATTITUDES FOR THE ALBERTA HIGH SCHOOL GRADUATE *


Self-Concept and Lifestyle
Interpersonal Relations
Critical and Creative Thinking
Communication
Science and Mathematics
Lifelong Learning
Citizenship
Career Exploration
Consumer and Producer Awareness
Global and Environmental Awareness

* Thornton, M. (1987). Essential Concepts, Skills and Attitudes for Grade 12. Second Draft Alberta Education, May.

3. Testing Program - Alberta Education

In order to monitor how well students are learning the content outlined in Alberta programs of study and curriculum guides, achievement tests in selected subject areas are administered in grades 3, 6 and 9. Diploma examinations in major subject areas are written by grade 12 students.

Table 1 and Table 2 display the Alberta Achievement Tests and Diploma Examinations respectively. The tables illustrate the emphases on cognitive levels that the tests and examinations purport to measure. Alberta Education uses Bloom's Taxonomy of educational objectives to develop test and examination questions. Table 1 shows that most questions are designed to test the lower levels of Bloom's taxonomy; namely, knowledge, comprehension and application. No questions are designed to test the higher mental activities of analysis, evaluation and synthesis in mathematics and science. However, the grade 9 English test (Part B), measures evaluation. Table 2 indicates that most questions reflect the lower taxonomic levels while a small percentage measures "higher mental activities."

Test developers with Alberta Education believe that intellectual processing can be taught and that greater emphases should be placed upon questions that tap the higher mental processes which include synthesis, evaluation and creativity in future tests and examinations.

Achievement Test Blueprints: Cognitive Levels and Per Cent Emphases*

Table 1

Achievement Tests	Cognitive Levels			
	Knowledge	Comprehension	Application	Problem Solving Skills
Grade 3 Mathematics	22 %	38 %	18 %	22 %
Grade 6 Science	14 %	--	86 %	--

	Cognitive Levels		
	Literal Understanding	Inferential Understanding	Evaluation
Grade 9 English Language Arts Part B:Reading (Mulitiple Choice)	9.4%	53.1%	37.5%

*Alberta Education (1986)

Grade 12 Diploma Examinations Blueprints: Cognitive Levels and Per Cent Emphases *

Table 2

<table>
<tr><th rowspan="2">Diploma Examination</th><th colspan="4">Questions By Cognitive Level</th></tr>
<tr><th>Knowledge</th><th>Comprehension</th><th>Application</th><th>Higher Mental Activities</th></tr>
<tr><td>Mathematics 30</td><td>11%</td><td>37%</td><td>41%</td><td>11%</td></tr>
<tr><td>Biology 30</td><td>30%</td><td colspan="2">53%</td><td>17%</td></tr>
<tr><td>Chemistry 30</td><td>35%</td><td colspan="2">49%</td><td>16%</td></tr>
<tr><td>Physics 30</td><td>34%</td><td colspan="2">50%</td><td>16%</td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th colspan="3">Cognitive Levels</th></tr>
<tr><th>Literal Understanding</th><th>Inference and Application</th><th>Evaluation</th></tr>
<tr><td>English 30 (PartB:Reading)</td><td>4%</td><td>33%</td><td>13%</td></tr>
<tr><td>English 33 (Part B: Reading)</td><td>4%</td><td>37%</td><td>13%</td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th colspan="5">Process Categories</th></tr>
<tr><th>Recall and Comp.</th><th>Inquiry Skills A[1]</th><th>Inquiry Skills B[2]</th><th>Inquiry Skills C[3]</th><th>Valuing Skills</th></tr>
<tr><td>Social Studies 30 (Part A: Multiple Choice)</td><td>36%</td><td>6%</td><td>18%</td><td>6%</td><td>4%</td></tr>
</table>

[1] **Inquiry Skills A - Indentify and focus on the issue and formulate research questions.**

[2] **Inquiry Skills B - Gather, organize, analyze, evaluate,and synthesize data.**

[3] **Inquiry Skills C - Resolve the issue, apply the decision, and evaluate the decision, process, and action.**

*** Alberta Education (1986)**

1.6. Purpose of Project

The study presumed that classroom practice tends to emphasize content and teaches thinking skills incidentally, leaving the children to learn them as a result of modelling or by inference.

The investigators believe that deliberate teaching of thinking skills with an explicit purpose, practice and related evaluation leads to more effective learning. This study aimed to assist teachers to make the children conscious of thinking skills used in classroom routines. The study had three specific purposes:

1. To provide teachers and students with a set of thinking skills.
2. To develop and validate a model of cognition for teachers.
3. To devise a Measure of Questioning Skills and establish a normative base for this instrument.

1.7. Research Questions

The project generated six research questions for examination:

1. Did teachers and students develop identifiable understandings and implement thinking skills as a result of the project?
2. What does the project teach about the introduction of new concepts or curricula into the schools?
3. What pertinence does a validated cognitive model have for classroom practice?
4. In what ways can schools use the Measure of Questioning Skills?

5. Will the treatment group (teachers and students, grades one to six in Lethbridge Catholic Separate School District No.9) increase scores on standardized tests, as a result of professional development related to teaching thinking skills, more than the comparison group, (teachers and students, grades one to six in Red Deer Catholic School District No.17) who receive no such treatment?

6. What resources or information proved useful to teachers in developing their understanding and use of thinking skills in the classroom?

CHAPTER 2

Methodology

The primary methods used to assess the effect of the project were the administration of standardized tests before and after the implementation of the project; and the use of questionnaires to obtain subjective data from teachers, students, principals and parents.

2.1. Objective Testing of Students and Teachers

(a). Canadian Tests of Basic Skills (C.T.B.S.)

The C.T.B.S. are published by Thomas Nelson (Canada) Limited. The C.T.B.S. Battery was adapted from the Iowa Tests of Basic Skills prior to 1970. The adaptation was made to provide for Canadian content and cultural factors.

Following the adaptation, the test battery was normed on a representative standardization sample of Canadian students in 1967. Re-norming occurred in 1974. Form 5 Level 6 - 14 (1982) was used in this study. The complete battery of C.T.B.S. takes about four and one-half hours of working time for the students to complete.

The C.T.B.S. battery consists of tests which provide the following scores: grade equivalent, percentile rank, the standard scores. The following basic and sub-skill areas were tested varying with grade and test level:

Listening
Vocabulary
Word Analysis
Language Skills . . . (a) Spelling

	(b) Capitalization
	(c) Punctuation
	(d) Usage
Work-Study	(a) Map Reading
	(b) Reading Graphs and Tables
	(c) Knowledge and Use of Reference Materials
Mathematics	(a) Concepts
	(b) Computation
	(c) Problem Solving

(b) **Security Tests**

The Institute of Child Study (ICS) Security Tests - **The Story of Jimmy** - Elementary Form (1957) and **The Story of Tommy** - Primary Form (1964) were developed by Grapko, and are based on Blatz' concept of security (1944).

The ICS Security Test - **The Story of Jimmy** - Elementary Form - is designed to elicit an order of preference for various behavioral responses to each of 15 situations in story form, with five choices of action for each situation. The situations in story form sample activities which deal with adult-child relationships, school performance, and leisure time. For example:

> Jimmy goes to school. He gets up in the morning, gets washed and dressed, and then greets his mother at breakfast. This morning, however, Jimmy slept in and when he awoke he found that he was going to be late for school. Since Jimmy isn't usually late for school, he wasn't too sure what to do. After a moment it occurred to Jimmy to:

give the excuse that the alarm clock didn't ring..(4)
wait for his mother to help him hurry up..........(3)
rush as fast as possible so as not to be too late(1)
start to cry.......................................(5)
explain to the teacher when he arrived late at school...(2)

(ICS Security Test Booklet, p.2)

The child is asked to rank the five choices from 1 to 5 to indicate his order of preference. The numerals in the test example represent ideal ranking in terms of security theory.

Two composite scores are provided by the test, namely, security and consistency. A high security score (range of 0-100) measures the child's confidence in his ability to accept consequences for his own actions and decisions. A high consistency score (range of 0-100) identifies the similarity of response pattern the child is likely to select over the 15 story situations. A high score measures the child's organizational ability and good work habits.

Five component scores are also provided by the test, namely independence (IS), peer dependence (MDS), dependence on adults (IDS), avoidance mechanisms (DA), and anxiety (INS). Each component score ranges from 15 to 75. A low score indicates preference for that particular security component. For example, a low MDS score indicates that a child sees strengths in his or her peer relationships and contributes to peer social effectiveness. A low IS score indicates the person's preference for skilled, self-initiating, independent behaviour. These children like to work on their own. A low IDS score results when an individual prefers adult help and intervention. Preference for defensive behaviour is indicated in a low DA score. These individuals make excuses for their shortcomings, and evade facing up to the consequences of their actions. High scores indicate high moral or conscience development. A low INS score indicates preference for anxiety behaviour. These children are unable to decide any course of action for themselves.

The ICS Security Test - **The Story of Tommy** - Primary Form - is designed for Grades 1, 2, and 3 children. This test is also a semi-projective paper and pencil task, in the form of a story. The subject ranks, in order of preference, four alternatives of behaviour for the hero. Each of these four alternatives operationalizes a subcategory of security. Independent Security (IDS) is the process whereby the individual, unsure or unskilled in facing a task, actively seeks help or support. The concept of Deputy Agent (DA) is akin to that of defence mechanisms, whereby persons avoid accepting the consequences of their behaviour. Finally, Insecurity (INS) is the state of almost total inability to cope with a task or situation.

For each of the four categories, the test offers a score which is an expression of the preference for that particular alternative. A Consistency Score (CS) is derived which depicts the extent to which the pattern of response is consistent. A final Security Score (SS) is also obtainable which reflects the relationship of the subject's response pattern to that established as an ideal or most secure pattern.

(c) School Subjects Attitude Scales

The **School Subjects Attitude Scales** (1982) was developed by two University of Alberta professors during 1978 and 1979. The development was funded by the Planning Services Branch of Alberta Education.

The purpose of the scales was to make available an instrument for measuring students' attitudes toward school subjects. An important goal of schooling deals with the development of the affective domain of students. Until the development of this instrument, none was available to measure this dimension. The scales were developed as group (classroom) measures of students' attitudes toward school subjects in Grades 5 through Grade 12. They were not intended for use with individual students.

Twenty-four bipolar adjectives constitute the test. These word pairs are classified into three scales: evaluation, usefulness, and difficulty. The students express their attitude toward the subject by placing a mark on the 5-point scale between each of the 24 adjective pairs.

(d) **Torrance Tests of Creative Thinking (TTCT)**

The **Torrance Tests of Creative Thinking** measure creativity by assessing four important mental operations: fluency, flexibility, originality, and elaboration. The Figural TTCT was used in the study and uses picture-based exercises that require students to complete open drawings, construct new pictures, and elaborate common shapes. The streamlined scoring technique was used. This alternative scoring is an expansion of regular scoring, and yields norm-referenced measures for fluency, originality, abstractness of titles, elaboration, and resistance to premature closure. It provides criterion-referenced scores for 13 creativity indicators and a Creativity Index, which has been found to serve well as an overall indicator of creative potential.

(e) **The Human Information Processing Survey**

The Human Information Processing Survey (HIPS) is used in the field of human resource development. Individuals are assessed in terms of hemisphere processing preference - left, right, integrated, or mixed. Each preference is briefly explained as follows:

Left Dominant Information Processor

This individual strongly prefers to deal with problems in an active, verbal, and logical manner. There is a modest preference for the right hemisphere showing that the "intuitive" strategy will be used only when absolutely necessary. This person prefers an organization with realistic, economic goals where there is a concern for factual detail in decision making. For this person control and clear assignments of responsibility have a high priority. Everybody knows what they are supposed to do with an emphasis on the work to be accomplished. There is a well-defined, centralized organization structure where procedures and guidelines have been worked out for work performance. This person's preferred organization is task oriented.

Right Dominant Information Processor

This individual strongly prefers to deal with problems in a receptive, spatial, and intuitive manner. There is a modest preference for the left hemisphere showing that the "logical" strategy will be used only when absolutely necessary. This person prefers an organization that focuses on idealistic, humanistic goals where there is a concern for broad overall issues. For this person the exercise of self-initiative will have a high priority within the context of loose lines of authority. Everybody feels they can share in the organization's direction since there is an emphasis on the people who occupy positions. There is a diffuse, decentralized organization structure where flexible rules for behaviour and performance have been developed. This persons's preferred organization is people oriented.

Mixed Information Processor

This individual uses either a left dominant or a right dominant strategy depending on the situation. The larger of the Standard Scores for left or right indicates this individual's preference if other things are equal. The weak connection between the hemispheres suggests this person's tendency to shift between left and right modes.

Integrated Information Processor

This individual operates simultaneously in the left and right mode of processing without a clear preference for either. The larger of the left or right Standard Scores suggests the direction the person will move if pressured to express a dominant mode. However the strong connection between the hemispheres indicates that the real preference is for using both hemispheres together.

The HIPS provides a description of a person's overall approach as well as specific tactics in problem-solving and decision-making.

New Jersey Test of Reasoning Skills (NJTRS)

The **New Jersey Test of Reasoning Skills** (1983) was selected as a measure of thinking skills based on the following considerations: the test concentrates on reasoning in language; it is simply and clearly written; and the skills tested are those which correspond to elementary and essential operations in the domain of logic. The reliability of the NJTRS compares favorably with established tests, ranging from .84 and above in grade 5 to .91 and above in grade 7.

2.2. Pretesting

Sample:

The sample for this study was selected from that population of students in regular school classrooms in Grades 1 through 6 in the fall of 1985. The total student enrolment in the study school districts is shown in Table 3. The Lethbridge Separate School District consisted of 52 classrooms from Grade 1 through Grade 6, but a decision was made at the beginning of the project, that for practical reasons only one-half of the classrooms would be included in the testing. In addition, the seven Grades 1-3 French Immersion Classes were eliminated from the study prior to the sample selection because of anticipated difficulty with the English Language Testing. This left 45 classes in the study population, out of which 23 (51.1%) were randomly selected for pretesting, using a random digits table. The three tested Grade 6 classes were eliminated following the initial sample selection and testing because they would not be in the school for the second year of the study.

TABLE 3

Total Enrolments in the Participating School Jurisdictions

	Lethbridge - 5 schools				Red Deer - 6 schools	
Grade	Total No. of Classes	French Immers.	Number of Students	French Immersion	Total No. of Classes	Number of Students
1	11	3	246	67	7	126
2	9	2	228	47	7	158
3	8	2	196	50	7	164
4	8 (one 4/5 combined class)	2	212	45	6	146
5	8	2	211	40	6 (one 5/6 combined class	156
6	7	1	186	22	5	131
TOTALS	52	12	1279	271	39	881

In the comparison group, Red Deer Catholic School District No.17, the six Grade 4 classes were not included because they were involved in another study. Therefore a slightly better than 50% sample of the Grade 1-3 and 5 and 6 classes were initially tested for this study. However, as with the Lethbridge schools the Grade 6 classes were later eliminated and two other classes, a Grade 5/6 combined class, and a Grade 1 class, were also eliminated because of problems with the testing procedure.

It had been the intent of the investigators to use in the analysis of the results of the study the data from all of those tested. However, the numbers were large enough to allow statistically sound results with a smaller proportion of the total population. Thus a 50% sample of the tested group, excluding the Grade 6 classes and the two eliminated classes, was selected as the research sample. For the purposes of the final sample selection subjects were selected across grade levels rather than by classes. That is, all of the tested Grade 1 classes in the Lethbridge district were considered together and a 50% sample of that group was selected using a random digits table. The same procedure was followed for each grade level in both groups of the study. The resulting final sample used in this study is shown in Table 4.

TABLE 4

Final Student Sample by Group and by Grade Level

	Lethbridge					
	Study Population		Pre-test Sample		Post-test Sample	
	Classes	N	N	% of 1985 Pop.	N	% of 1985 Pop.
Grade						
1	8	179	48	26.8%	41	22.9%
2	7	181	56	30.9%	48	26.5%
3	6	146	38	26.0%	52	35.6%
4	8.5	212	51	24.1%	54	25.5%
5	8.5	211	61	28.9%	52	24.6%
Total	38	929	254	27.3%	247	26.5%

	Red Deer					
	Study Population		Pre-test Sample		Post-test Sample	
	Classes	N	N	% of 1985 Pop.	N	% of 1985 Pop.
Grade						
1	7	126	27	21.4%	33	26.2%
2	7	158	42	26.6%	45	28.5%
3	7	164	47	28.7%	25	15.2%
4	--	---	--	----	--	----
5	6.5	156	35	24.1%	77	49.4%
Total	27.5	604	151	25.0%	180	29.8%

All the teachers at each grade level in both districts were tested. However only those who had students in the resulting sample were included in the analyses; thus there were 20 teachers in the Lethbridge sample, and 14 in the Red Deer sample.

Procedure

Pretesting occurred during the fall of 1985. An individual was contracted to administer the tests to the teachers and to explain to them the test administration procedures. The teachers, in both Red Deer and Lethbridge, then administered the tests to their students.

Scoring

All tests were scored according to procedures prescribed for each test. The C.T.B.S. for Grades 4 and 5 were machine scored in Edmonton; Grades 1 to 3 were hand scored by two persons. Each student received a number of subscores depending on the particular level of test written, and a total score of all the subscores. Raw scores were used for all C.T.B.S. analyses.

The Security Tests were scored by The Institute of Child Study at the University of Toronto. Each student received two scores - a security score and a consistency score, each of which is based on five subscores; the maximum possible security and consistency scores were 100, and in each case higher scores are more characteristic of the trait being measured.

School Subjects Attitude Scales were computer-scored using the guidelines established by the test developer to create a mean score based on a 1-5 semantic differential scale for three attitude categories for each subject; the categories were evaluation, usefulness and difficulty.

The higher the mean score the more positive the students' attitudes.

The Torrance Tests of Creative Thinking were scored by a United States firm using the procedures outlined in the test manual. Each student received a standard score for each of five categories, plus an average standard score. The higher the mean, the higher the potential for creativity. Teachers wrote the Torrance Tests of Creative Thinking, which were scored the same way as for the students. In addition, the Human Information Processing (H.I.P.) Survey was self-scored. Teachers converted their raw scores to a standard score using the scale provided on the tests. Scores above 120 on any of the three dimensions indicated that the person used primarily the left or right hemisphere, or a combination of both, for processing information. For purposes of analysis teachers were classified into one of three categories: right-brain oriented, left-brain oriented, or integrated.

2.3. Posttesting

Sample.

The number of students in the study sample for the posttests is presented in Table 4 on page 24. For the posttesting the sample was chosen prior to the testing and was selected by class, rather than by students, in order to facilitate the administration of the tests. The student population was different after the two-year period, and the intent was to determine whether there were differences in the scores in the two jurisdictions at the various grade levels. The posttest sample was selected on the basis of the teachers in the pretest sample. From the group of 34 teachers (20 in the treatment group and 14 in the comparison group) who were in the pretest sample, approximately one-half were randomly selected as the basis for the posttest sample. Students in these teachers' classrooms were administered the tests in May and June of 1987. The numbers of students who completed the test is presented by grade level in Table 4.

Procedure

The testing procedure was the same as that used for the pretests, except that the NJTRS was added for Grade 5 students. Because this test specifically measures thinking skills it was selected to replace the C.T.B.S. as the posttest measure for Grade 5 students. Scoring procedures were also identical.

Analysis

All scores were entered in the computer and analyzed using the SPSS-x statistics package (SPSS-x, 1986). Since all data were in the form of raw or standard scores, or scores created from Likert-type scales, and since the sample was considered to be a random sample of the student and teacher populations in the two school jurisdictions, t-tests and analyses of variance were used to test for significant differences between school jurisdictions and among grade levels. Probabilities less than or equal to .05 were considered to be significant.

2.4. Subjective Testing of Students, Teachers, Principals and Parents.

Treatment of Lethbridge Teachers

The investigators gave each teacher a copy of the project proposal in May of 1985. Shortly thereafter in June, the investigators invited all teachers and staff participants to a supper at a local restaurant to introduce the proposal. To give significance to the study, the guest list included the local MLA, the Chairman of the School Board, the Dean of the Faculty of Education, University of Lethbridge and representatives from the local media.

The teachers had access to a library of books on thinking skills and creativity. Teachers received reprints from current journals. Teachers used cassette tapes and a set of videotapes to enhance their awareness.

Teachers participated in three in-service sessions of a day each. In the first, an external consultant provided most of the content. In the second, the authors provided some content, and some teachers put on demonstrations of teaching of Thinking Skills. In the third, the teachers presented demonstrations based on their study and experience in the classroom.

Individual teachers attended conferences and seminars related to thinking skills and creative problem-solving over the course of the project.

A chance happening in the form of the preparation of a video-tape on Teaching Skills for broadcast, provided the opportunity for additional in-service. The filming took place in one school and was subsequently viewed by other staff in the District. The title of the video-tape is Thinking Skills, part of the Learning to Live Series, (April, 1986) produced by the ACCESS network.

In the first months of the project, the research design provided for an observer to collect base-line data on classroom use of thinking skills for comparison with a similar observation schedule towards the end of the study. Although it was decided not to continue this procedure, the consultations which the observer had with teachers was valued. Appendix A contains the schedule used by the observer.

Data collection served a dual purpose. The first, of course, to provide a basis for conclusions and recommendations. At the same time, data collection served an in-service purpose inasmuch as these efforts kept the idea of thinking skills before the teachers. Thus, for example, questionnaires aimed at detecting recognition of the work on thinking skills went out in March of the second year. Primarily intended to assess teacher, student and parent consciousness of the project, they also raised that consciousness. See Appendix B for copies of the questionnaires for teachers, students, parents and principals.

2.5. Project Limitations

The standardized tests used may not directly measure the thinking skills which the teacher deliberately taught in the project.

No attempt was made to control the amount of time or the number of thinking skills taught during the project.

The investigators have no knowledge of the awareness and use of thinking skills used by the teachers in grades 1-6 in the Red Deer Catholic Schools.

2.6. Development and Validation of Cognitive Model

Early in the project the investigators sought to develop a way to conceptualize how people manage information. A model was developed by the investigators and validated by selected educators in Alberta.

2.7. Development and Norming of A Measure of Questioning Skills

The investigators assume the importance of the ability of students to ask questions. A review of the literature revealed little research or study on the act of questioning by students in the management of information.

The investigators aimed at developing a measure which would assess the quality and quanity of questions which students asked. Furthermore, they aimed to develop a schema which would enable the teachers to analyze the questions of students and so plan their instruction.

Two experimental editions of the measure were tested in grades 3-10. A guide was developed to assist teachers in the use of the **Measure of Questioning Skills** and to assist in the interpretation of the results.
The investiators administered the instrument to students in grades 3 through 10. Norms were tabulated by the Educational Research Department, University of Lethbridge. The norms appear in the Users' Guide.

2.8 Users Guide

Copies of the two experimental editions of the **Measure of Questioning Skills** and the **User's Guide** are found in Appendix F.

CHAPTER 3

Results

3.1. Objective Measures

Early in the project a decision was made to use posttest scores rather than gain scores, as the basis for the analysis. It is now widely accepted that there are serious difficulties in using gain scores to measure change from pretest to posttest (Borg & Gall, 1983,pp.720-723). Recommended statistical techniques are to use analysis of covariance, with pretest scores as a covariate, or to use analysis of variance for repeated measures where the testing time is one factor and the treatment and comparison groups are the other factor. However, since two years elapsed between pre and posttesting, different students were tested at each time. Also the intent was to compare the results in two different school districts. Thus, pretest scores were used simply to determine whether there were initial differences in the populations which would suggest particular cautions in interpreting the posttest results.

Results of Pretesting

Students' overall mean scores for each of the tests by grade level and by school district are presented in Tables A and B in Appendix C. Summaries of subscale scores are presented in Tables C through F. If a particular test was not written by a group of students it is indicated in the table by the symbol "n/a". T-Tests and analyses of variance were performed on the total or overall average scores for each test to determine significant differences between Lethbridge and Red Deer students.

C.T.B.S. Results

Mean scores on the C.T.B.S. by grade level within each school district are presented in Table C. Student achievement, as measured by the total score on the **Canadian Test of Basic Skills** was significantly different only at the Grade 1 level (*t*=13.27, *df*=69, *p*=.002), where the mean raw score for Lethbridge students was 125.70 (*SD*=14.51) and for Red Deer students was 134.00 (SD=7.15). Red Deer students in Grade 1 scored significantly higher than did their Lethbridge counterparts.

Security Tests

Students in Grades 1 through 4 wrote the "Tommy" version of the Security Test, while students in grades 4 and 5 completed the "Jimmy" version of the test. Table D summarizes the mean consistency, security and subscale scores by grade level, within each school district. Two-way ANOVAS were used to test for significant differences in security and consistency scores between school districts and among grade levels. For primary students (Tommy test), there was an overall significant difference on both security (*F*=15.63, *df*=5, *p*=>.001) and consistency scores (*F*=11.10, *df*=5, *p*=>.001).

Red Deer scores on the Tommy test were significantly higher than Lethbridge scores for both security and consistency. In terms of grade level, Grade 3 security scores were significantly higher than those of the two other grades, and Grade 2 security scores were significantly higher than Grade 1 scores.

Consistency scores differed in that the Grade 3 students scored significantly higher than Grade 1 and 2 students; no other differences among grade level groups were statistically significant.

When scores were compared by grade levels, Grade 1 security and consistency scores in Red Deer were significantly higher than Grade 1 scores in Lethbridge (for security $t=-3.52$, $df=71$, $p=>.001$; for consistency $t=3.89$, $df=71$, $p=>.001$). Grade 3 students in Red Deer scored significantly higher than their Lethbridge counterparts on the security score ($t=2.33$, $df=76$, $p=.023$) but not on the consistency score. There were no significant differences between the scores of Grade 2 students in the two school jurisdictions.

Results were similar for the "Jimmy" version of the Security Test written by Grade 4 and 5 students. Overall, two-way ANOVA results were significant for both security and consistency scores (for security $F=6.77$, $df=2$, $p=.002$; for consistency $F=10.85$, $df=2$, $p=.000$). However, when effects were examined separately, scores on the "Jimmy" test were not significantly different between school jurisdictions. The significant overall F value was a result of significant differences between grade levels on the security score. However, Grade 4 students in Red Deer did not write these tests. When the scores of Grade 5 students only were compared there was no significant difference between the Lethbridge and Red Deer students on the security or the consistency scores of the "Jimmy" test.

School Subjects Attitude Scales

Attitude scales for Mathematics and Language Arts were administered to Grade 5 students in both school districts. Mean scores, for total and subscales of each test were presented in Table E. Lethbridge students scored higher on the attitude scales for both Language Arts and Mathematics; however, the difference was significant only in attitude toward Language Arts (t=2.88, df=69, p=.005); Lethbridge students' mean overall score was 3.94 (SD=0.49, N=46, on the 5-point scale, compared with a mean score of 3.56 (SD=0.61, N=25) for Red Deer Grade 5 students.

Torrance Tests of Creative Thinking

Finally, students in Grades 1 through 5 completed the **Torrance Tests of Creative Thinking.** Table F summarizes the mean standard scores on the Torrance Test, by grade level within each school district. Since no Grade 4 students in Red Deer were tested, the mean standard score on the Torrance Test was tested for significant differences using results from Grade 1, 2, 3 and 5 students (thus the mean score for Lethbridge differed slightly from that on Table F). There was a significant difference overall between groups (F=3.37, df=7, p=.002). Specifically, Red Deer students had a significantly higher overall standard mean score (M-99.12, SD=11.08, N=197) (F=18.19, df=11, p=.000). When school jurisdication overall mean scores were compared at each grade level, Grades 1, 2 and 3 Red Deer students scored significantly higher than did Lethbridge Grades 1, 2 and 3 students. There was no significant difference between Lethbridge and Red Deer students grades 4 and 5, or between mean scores by overall grade level.

Teacher Pretest Results

The analysis presented in this section is based only on the test scores of teachers who had students in the study. These teachers completed two tests; the **Torrance Tests of Creative Thinking** and the **Human Information Processing Survey.** A summary of the classification of human information processing type, as indicated by standard scores on the H.I.P. Survey, is given by school jurisdiction and grade level in Table G in Appendix C. Mean scores for the total and subscales of the Torrance Tests are presented by jurisdiction in Table H, and by grade level within district in Table I in Appendix C.

H.I.P. Survey

Three separate standard scores were provided by the H.I.P. Survey instrument, measuring the use of the left or right hemisphere of the brain or integrated processing by the brain. These were used to classify each teacher into one of four types. If the teacher has a standard score of 120 or greater on any one of the three scales (left, integrated, right), they were then classified as a left, integrated, or right brain type of information processor, respectively. A teacher would be classified as being a "mixed" processor of information if none of their three standard scores was greater than or equal to 120 (see Table G). Sample sizes were too small to perform a chi-square test of significance on the HIP type by school jurisdiction. However, in general, for both Lethbridge and Red Deer, 50 per cent of the teachers were classified as "mixed" information processors. Ten percent of the Lethbridge teachers were classified as "integrated" information processors, compared to 43 per cent of the Red Deer teachers; as well, no Red Deer teacher was classified as "right" brain information processors, while 25 per cent of the Lethbridge teachers were so classified. Finally, 15 per cent of the Lethbridge teachers were classified as "left" brain information processors, compared to 7 per cent of the Red Deer teachers.

Torrance Tests of Creative Thinking

Finally, the teachers' average overall Torrance Test standard score was tested for significant differences by school jurisdiction and grade, using a two-way ANOVA. Differences in the average Torrance Test standard scores were significant overall (F=4.24, df=7, p=.005). Examining the effects separately, there was no significant difference between teachers' scores in the two school jurisdictions, but there was a significant difference among teachers at different grade levels (F=3.66, df=3, p-.030). Grade 1 teachers in general had a higher overall mean score than the other three grade levels included in the analysis, although this was not statistically significant according to post hoc tests. However, when teacher scores were examined separately by grade level, Grade 1 Lethbridge teachers scored significantly higher than did Red Deer Grade 1 teachers (t=3.3.4, df=5, p-.021), while Grade 5 teachers in Red Deer scored significantly higher than did Lethbridge Grade 5 teachers (t=-4.23, df=5, p=.008).

The ANOVA result was also significant in terms of the interaction between school jurisdiction and grade effects (F=5.54, df=3, p=.006). Perhaps this is due to the fact that Grade 1 teachers scored significantly higher than Grade 5 teachers among the Lethbridge teachers, while Grade 5 teachers scored significantly higher than Grade 3 teachers in the Red Deer school jurisdiction. That is, higher scores on the Torrance Tests were related to both school jurisdictions and grade levels.

Summary Statement - Pretest Analysis

There were a number of interesting differences among test scores at various grade levels. However, since the purpose of the pretesting was to establish some basis on which to make statements about posttest results, only differences between jurisdictions are highlighted here. Differences in test means which were statistically significant at an alpha level of .05 are as follows:

Students

C.T.B.S. - Grade 1; Red Deer higher
Security Test -Grade 1: Red Deer higher on security and consistency.
-Grade 3: Red Deer higher on security
SSAS (Grade 5 only) - Language Arts: Lethbridge higher
Torrance -Grade 1,2 and 3: Red Deer higher

Teachers

H.I.P.S. -(no difference tested)
Torrance -Grade 1: Lethbridge higher
-Grade 5: Red Deer group higher.

Results of Posttesting

Overall mean scores for students, for each test by grade level and school jurisdiction are presented in Tables 5 and 6 on page 45 and 46 and indicate that there were no differences.. Summaries of subscales for those tests are presented in Tables J through M in Appendix D. Teacher results are presented in Tables N to P in Appendix D. As with the pretesting results, if a test was not written by a group of students this is indicated by the symbol "n/a" in the tables. Again, t-test or analyses of variance were used to test total or overall mean scores for each test, for significant differences between school jurisdictions and among grade levels.

C.T.B.S. Results

Mean scores on the C.T.B.S. by grade level within each school jurisdiction are presented in Tables 5 and 6 on pages 45 and 46. Subscale results are in Table J in Appendix B. Grade 4 students in Red Deer did not complete any testing, and Grade 5 students did not write the C.T.B.S. in the posttesting portion of the study; instead, they completed the **New Jersey Test of Reasoning Skills.** As well, due to a problem with the testing and/or scoring procedure, the posttest scores for the Red Deer Grade 3 class were inaccurate and were not used. There were no significant differences in student achievement scores between school jurisdictions for Grade 1 and 2 students.

Security Tests

In the posttesting, students again wrote the Security Test; the version of the test completed was dependent on the grade level of the student, with students in Grades 1 through 3 writing the "Tommy" version, and students in Grades 4 and 5 writing the "Jimmy" version. Mean scores are summarized by school jurisdictions and grade level in Table K.

For the "Tommy" version (Grades 1-3), a two-way ANOVA by school jurisdiction and grade was used to test for significant differences in security and consistency scores between school districts and among grade levels. There was an overall significant difference for both security ($F=13.38$, $df=5$, $p=.000$) and consistency ($df=5$, $p=.000$); however when effects were analyzed separately for security and consistency scores, school jurisdiction was *not* a significant source of variation. Significant differences were due to differences among grade level (for security, $F=29.51$, $df=2$, $p=>.001$; for consistency, $F=33.73$, $df=2$, $p=>.001$). A post hoc analysis revealed that each grade level scored significantly higher than the earlier grade level. In addition, for security scores, the interaction between school jurisdiction and grade level was significant. This significant interaction is possibly explained by the fact that Red Deer Grades 1 and 3 mean scores were higher than Lethbridge Grades 1 and 3 scores, while Lethbridge Grade 2 scores were higher than Red Deer Grade 2 scores, although these differences were not statistically significant.

A comment should be made about these scores. The Red Deer Grade 1 security and consistency results had been significantly higher than the Lethbridge results in the pretesting situation. Following the project, that is, in the posttesting situation, the differences between districts had decreased, indicating perhaps a higher gain for Lethbridge students. For Grade 2 the pretesting differences, though not statistically significant, had favoured the Red Deer students; the posttest difference favoured Lethbridge students, although again the difference was not statistically significant.

Grade 4 students in Red Deer did not write any tests, thus the results for the "Jimmy" version of the Security

Test were compared by school jurisdiction for Grade 5 only. Lethbridge Grade 5 students scored significantly higher than Red Deer grade 5 students on both security and consistency (for security, *t*=4.42, *df*=122.12, *p*=>.001; for consistency, *t*=3.80, *df*=123, *p*=>.001). Lethbridge Grade 5 students had also scored slightly, but not significantly, higher on the pretest.

School Subjects Attitude Scales

As for the pretesting, Grade 5 students in both school districts completed attitude scales for Language Arts and Mathematics. Mean scores for each subject, overall and for the three subscales, are presented in Table L in Appendix D. Lethbridge students scored significantly higher overall on the attitude scales for both Language Arts and Mathematics (for Language Arts, *t*=2.52, *df*=90.01, *p*=.013; for Mathematics, *t*=8.03, *df*=91.22, *p*=.000). On a 5-point scale, where a more positive attitude is indicated by a higher score, Lethbridge students had a mean score on the Language Arts scale of 4.00 (*SD*=.45, *N*=41) compared to a mean score for Red Deer students of 3.65 (*SD*=0.92, *N*=59). Similarly, for the Mathematics attitude scale, Lethbridge students' mean score was 4.28 (*SD*=0.38, *N*=62). The Lethbridge scores had also been higher on the pretests, although then the difference was significant only for Language Arts, and the differences were not as great.

Torrance Tests of Creative Thinking

Students in Grades 1 through 5 completed the **Torrance Tests of Creative Thinking** as part of the posttesting. Mean standard scores on the Torrance test for posttesting are presented in Table M in Appendix D, by school district and grade level. Only mean standard scores for students in Grades 1 through 3, and Grade 5, were used to test for significant differences, as no Grade 4 students in Red Deer wrote the tests.

A two-way ANOVA was performed on student mean standard scores on the Torrance test, using school jurisdiction and grade level as factors. Overall, there was a significant difference between groups on the Torrance test (F=7.26, df=7, p=>.001), caused by both differences between school jurisdictions and among grade levels. Red Deer students had a higher overall score on the Torrance Test (M=98.15, SD=11.34, N=173) than their Lethbridge counterparts (M=96.51, SD=12.21, N=187) (F=5.93, df=;, p=.015).

Mean standard scores were tested for differences between school jurisdictions at each grade level (except Grade 4). At all grades except Grade 2, Red Deer scores were slightly higher, although a significant difference was found only for Grade 1 students (t=3.10, df=69, p=.003). Red Deer Grade 1 students had a higher mean standard score on the Torrance test (M=99.11, SD=11.98, N=31) than did Grade 1 students in Lethbridge (M=91.19, SD=9.56, N=40). In the pretesting situation Red Deer students had also had higher scores; for Grade 1, 2 and 3 the pretest differences were statistically significant. Thus for Grades 2 and 3 there may have been a greater increase in Lethbridge scores than in Red Deer scores.

Differences in overall mean scores by grade level on the Torrance test were also indicated by the ANOVA (F=13.66, df=3, p=>.001). Post hoc analysis on the scores of Grades 1, 2, 3 and 5 students showed that the scores of students in Grade 5 and 1 differed significantly from those of students in Grade 2 and 3. Grade 2 and 3 students had higher mean standard scores on the Torrance test than did students in grade 1 and 5.

New Jersey Test of Reasoning Skills

Grade 5 students in both school jurisdictions completed the **New Jersey Test of Reasoning Skills** in the posttesting phase of the study. There was no significant difference in overall test scores between Lethbridge and Red Deer students , on the NJTRS. The mean scores were approximately 57 percent and 56 percent respectively, and standard deviations were almost identical.

Teacher Posttest Results

Only the scores of teachers with students in the posttesting portion of the study were included in the analysis summarized in this section. Teachers completed the **Human Information Processing Survey,** and the **Torrance Tests of Creative Thinking.** A summary of posttest classification of teachers' human information processing type is presented by school district in Table N in Appendix D. Mean scores on the Torrance test are presented by school district in Table O, while mean scores by grade level within each school district are presented in Table P.

Since the number of teachers with students involved in the posttesting portion of the study was too small to do analyses of variance by school district and grade, and since there were no testing results for Grade 3 or 4 teachers in Red Deer, teacher scores were tested for difference between school jurisdictions only.

H.I.P. Survey

Teachers were classified as one of the four information processing types, based on their standard scores on the HIP Survey. As with the pretest results, a standard score of 120 or greater on either the left, integrated or right scale, meant a categorization as left, integrated or right brain information processing type. The "mixed" classification applied when none of the three standard scores was 120 or greater. See Table N in Appendix D. Since there were only seventeen teachers in the posttesting sample, the summary appears only by school jurisdiction with no breakdown by grade level.

As well, it was not possible to test for significant differences between school jurisdictions because of the nature of the results and the small sample size. However, in both school jurisdictions roughly 40 percent of the teachers were classified as "mixed" information processors. Forty percent of Lethbridge teachers were classified as "right" information processors, compared to 9 percent of the Red Deer teachers. Twenty percent of the Lethbridge teachers were classified as "integrated" information processors, compared to 43 percent of the Red Deer teachers. Finally, there were no "left" information processors in Lethbridge while in Red Deer, 14 percent of the teachers were so classified. It should be noted, however, that the sample size is very small, so it is difficult to draw conclusions from these results, or to compare the pretest and posttest results. However, in general, it appears that roughly equal proportions of teachers in both school districts were classified as "mixed" information processors; a higher proportion of Red Deer teachers than Lethbridge teachers were classified as integrated information processors, and a considerably higher proportion of Lethbridge teachers were classified as right brain information processors. These differences were apparent in both pre and posttesting situations.

Torrance Tests of Creative Thinking

There was no significant difference by school jurisdiction, on teachers' mean standard scores on the Torrance test. Again, since the sample size was so small, it would have been improper to perform a two-way ANOVA by school district and grade level, as had been done on the pretest scores.

Summary Statement - Posttest Analysis

Differences between school jurisdiction on posttest scores, significant at an alpha level of .05 were as follows:

Students

Security test - Grade 1 to 3 - no differences
- Grade 5 - Lethbridge higher for both security and consistency.

SSAS - (Grade 5 only) - Lethbridge higher for both Mathematics and Language Arts

Torrance - Red Deer higher overall; specifically, Grade 1 Red Deer higher than Grade 1 Lethbridge.

NJTRS - No difference.

TABLE 5

Means and Standard Deviations of Grades 1,2 and 3 Students' Posttest Scores

	Grade 1						Grade 2						Grade 3					
	Lethbridge			Red Deer			Lethbridge			Red Deer			Lethbridge			Red Deer		
Measure	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	S
Canadian Test of Basic Skills (Total-Raw Scores)	38	139.21	8.25	33	140.73	6.28	42	295.00	34.47	34	307.85	24.50	51	312.39	37.48	-	--	-
Security Tests																		
Security	41	60.51	12.24	33	65.51	9.66	47	72.31	10.53	40	68.29	11.83	50	75.22	10.80	23	78.22	5.
Consistency	41	18.36	12.85	33	20.43	15.54	47	33.84	18.35	40	28.81	18.03	50	38.95	17.58	23	47.16	13.
Torrance Tests of Creative Thinking (Standard Scores)																		
Total	40	91.19	9.56	31	99.11	11.98	47	101.26	13.11	43	99.33	13.20	51	101.02	11.84	24	104.24	8.
Fluency	40	87.43	12.43	31	87.68	14.63	47	110.85	28.25	43	87.19	15.45	51	97.39	13.76	24	92.50	10.
Originality	40	113.78	29.94	31	109.16	27.53	47	114.62	28.62	43	118.79	31.08	51	121.37	26.44	24	136.13	22.
Titles	40	92.78	15.81	31	116.71	23.60	47	107.74	23.96	43	117.93	22.07	51	109.69	16.91	24	115.50	13.
Elaboration	40	74.35	8.55	31	87.87	7.60	47	81.70	9.09	43	79.26	10.01	51	86.71	7.36	24	81.33	5.
Resistance to closure	40	87.63	15.11	31	94.13	14.33	47	91.38	15.47	43	93.47	18.46	51	89.94	16.92	24	95.75	18.

* Based on responses to a 5-point scale, where 5=most positive response and 1=least positive response.

TABLE 6

Means and Standard Deviations of Grades 4 and 5 Students' Posttest Scores

	Grade 4						Grade 5					
	Lethbridge			Red Deer			Lethbridge			Red Deer		
Measure	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD
Canadian Test of Basic Skills Total	52	212.85	55.07		n/a			n/a			n/a	
Security												
Security	51	66.58	14.17		n/a		50	74.07	9.64	75	64.98	13.32
Consistency	51	25.12	17.08		n/a		50	34.45	18.53	75	22.15	17.16
School Subjects Attitude Scales												
Mathematics		n/a			n/a		42	4.28	0.37	62	3.32	0.82
Language Arts		n/a			n/a		41	4.00	0.45	59	3.65	0.92
Torrance Tests of of Creative Thinking												
Total	54	92.37	8.38		n/a		49	91.61	10.02	75	95.12	9.87
Fluency	54	95.52	16.63		n/a		49	84.22	14.80	75	88.79	15.82
Originality	54	103.26	21.28		n/a		49	108.39	19.65	75	112.35	20.24
Titles	54	99.50	17.57		n/a		49	105.51	15.18	75	108.87	20.33
Elaboration	54	76.94	6.29		n/a		49	74.55	7.11	75	77.84	7.70
Resistance to closure	54	86.61	10.33		n/a		49	85.37	16.89	75	87.77	17.08
New Jersey Test of Reasoning Skills Total out of 50		n/a			n/a		48	28.31	7.26	75	27.97	7.24

3.2. SUBJECTIVE DATA

Questionnaires: In March of 1987, teachers, students and parents in the treatment group received questionnaires designed to assess the effect of the project. See Appendix B for copies of the questionnaires.

Summary of results of teacher questionnaire (N = 42)

QUESTION 1: How has the Thinking Skills Project affected your teaching?

Growth in awareness of purpose in the lesson (62%).

Supported ideas and techniques used heretofore (10%).

QUESTION 2: What Thinking Skills have you used explicitly in your teaching as a result of the project?

Brainstorming, estimating, predicting and questioning (26% - 52%).

Use of skills of classifying and changing point of view, categorizing, hypotesizing, inferring, measurement, synthesizing, managing errors, defining, comparing, analyzing, deferring judgement, incubating, speculating and note taking (range of 18% - 29%).

QUESTION 3: What effects of the Thinking Skills Project have you observed in the work of your students?

More and better questions.
Greater openness to others.
More critical of their own work.

- Some use of the language of thinking.
- Hypothesizing.
- Increased thoroughness in work.
- Less fear about making errors.
- Desire to know the reason for doing things.

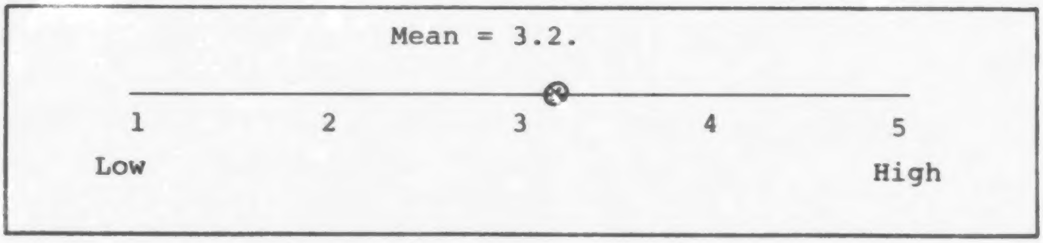
Question 4: **How can a teacher give recognition to students for the use of Thinking Skills?**

- Praise.
- Affirmation, or commendation.
- Added marks for the creation of stories using a new thinking skill.
- Use of a bulletin board display of the products of "thinking ". Use of thinking awards.

Question 5: **What resources or information did you find useful in understanding Thinking Skills and their application in the classroom?**

- Handouts, manuals, or books, videotapes and audiotapes (56%).
- Three in-service days (30%).
- Conferences on Thinking Skills.
- University course.
- Observation of the work of other teachers.

Question 6: **On a 5 point scale, note the effectiveness of the Thinking Skills project in influencing your teaching. (1-low; 5-high).**



Question 7: **Identify a strength of the project.**

- Increased awareness of Thinking Skills. (50%)
- Observation of more openness, confidence, increased resourcefulness in students. (18%)
- Increased clarity of purpose and focus with respect to teaching. (18%)
- Availability of added resources and appreciation of the focus on specific thinking skills.
- Satisfaction of working closely with colleagues on the project.

Question 8: **Identify a weakness of the project.**

- Project vague at the start. (32%)
- Evaluation and testing. (10%)
- Time consuming. (6%)
- Difficulty in transferring the information in the in-services from English to the French Language in the French Immersion school. (6%)

Question 9: **What recommendations have you for further action?**

- Parent education.
- Reprints.
- "Hands-on" materials.
- Sharing of ideas on Thinking Skills.
- Affirmation of the value of teaching Thinking Skills.
- More identification of specific skills to teach.
- Information on project results with recommendations.
- More workshops.
- Review sessions at year-end.
- Newsletters on Thinking Skills.
- Remember the needs of French Immersion.
- Sample lessons specific to grade and subject.
- Continued encouragement for the teaching of Thinking Skills in class.

Summary of Results of Student Questionnaire (N=1033)

All children, grades two to six in the Lethbridge schools responded to this questionnaire.

The following tabulations summarize the frequency of responses by thinking skills identified by students, across grade levels.

1. What thinking skills can you name?

	Grade Unspecified	2	3	4	5	6	Total
Brainstorming	46	19	6	19	45	18	133
Asking Questions	33	2		2	3	3	43
Categorizing (classifying)	8	1	11		10	1	31
Note Taking	15						15
Synergizing	7					3	10
Synectics	4					5	9
Measuring	8						8
Changing Point of View	5						5
Estimating	4					1	5
Incubating	1					2	3
P.M.I. (Plus, Minus, Interesting)	2						2
Use of Metaphors	2						2
Management of Error				1			1

2. What thinking skills have you used in your work at school?

	Grade Unspecified	2	3	4	5	6	Total
Brainstorming	24	13	6	4	20	10	67
Estimating	16					1	17
Asking Questions	6	4	1		2		13
Note Taking	11						11
Synergizing	11						11
Synectics	2			1		3	6
Sequencing				1	1	1	3
Measuring	1		1				2
Incubating						1	1

3. What thinking skill have you used at home?

	grade unspecified	2	3	4	5	6	Total
Brainstorming	3	6	7		9	6	31
Asking Questions	5	1			3		17
Categorizing (classifying)	3		3			3	9
Synectics	2				1	5	8
Estimating	4						4
Measuring	2					1	3
Synergizing	2						2
Sequencing	1						1
Incubating	1						1
Changing Point of View	1						1

4. What thinking skills have you used at play?

	Grade Unspecified	2	3	4	5	6	Total
Brainstorming	5	4	6	1	5		21
Synergizing	15						15
Categorizing (classifying)	2		3		2		7
Asking Questions	3						3
Estimating	2						2
Note Taking	2						2
Synectics	1					1	2
Sequencing					1		1
Measuring	1						1

Summary of Results of Parent Questionnaire (N=598)

The questionnaire to the parents asked if they had observed evidence of the effects of the emphasis on Thinking Skills in the behaviour of their children.

Thirty-two percent of the parents said they had observed something; sixty-four percent said that they had not observed any evidence of thinking skills while four percent were uncertain.

Typical comments follow:

- More questions asked.
- Child seems to figure things out for herself.
- Not automatically asking for help.
- More curious and open minded.
- Increase in use of dictionary and encyclopedia.
- Works more independently.
- Always asking questions; curious about everything.
- Child says they use brainstorming skills.
- She thinks of more ways to do assignments.
- She wants to think on her own.
- He has spoken of brainstorming and putting things in categories.
- He has always enjoyed looking at things from a different point of view.
- She likes to categorize things - colors etc. She suggests reasons for what she observes happening.

Summary of Principal's Questionnaires (N = 5)

1. **What effects (if any) of the Thinking Skills Project do you observe?**

   1.1. **In Teacher Behaviour?**

   Teachers are incorporating thinking skills in their teaching.

   1.2. **In Student Behaviour?**

   Some evidence of behaviour that reflects thinking skills such as questioning.

   1.3. **Comments from Parents?**

   Nothing reported.

2. **As Instructional leader in the school,**

   2.1. **In what way were you involved in the planning, implementation and evaluation of the project?**

   General support and specific participation in in-service and membership on steering committee.

   2.2. **In what way did you support, endure, affirm, comply with, or otherwise respond to the Thinking Skills Project?**

   Provided staff meeting time for dissemination of information and pre- and post testing.

   Provided articles on thinking skills to staff.

   2.3. **Should the District maintain an emphasis on thinking skills? If so, what do you suggest?**

   All principals said yes and recommended continuation of in-service sessions.

   "Blurbs" on thinking skills.

2.4. What would you have changed in the implementation of the project to increase its effect?

Less time on testing.

More background on actual thinking skills.

3.3. Validation of a Cognitive Model

The validation process permitted the development of a cognitive model. See Appendix E. Comments from selected educators were used to revise the cognitive model. Although the validators had many specific suggestions, all endorsed the model as valid and serviceable.

To facilitate the dissemination of the cognitive model, the investigators have submitted an article to the A.T.A. Magazine for publication in early 1988.

3.4. Results of the Development of A Measure of Questioning Skills

Norms were developed for grades 3 through 10 which provide normative data for each of the eight pictures which comprise the test. A total of 210 students in grade 3 to 10 in Lethbridge were administered the Measure of Questioning Skills. The Users' Guide provides a rationale for analyzing and interpreting student responses. In addition, suggestions to assist instructors in teaching the skills of questioning are provided. See Appendix F.

CHAPTER 4

Discussion and Recommendations

This chapter will examine the results in relation to the research questions and provide recommendations.

4.1. Research Question No. 1: Did teachers and students develop indentifiable understandings and implement thinking skills as a result of this project?

Most teachers said growth had occurred in their teaching of thinking skills as a result of the project and mentioned explicit teaching of a number of thinking skills, such as, brainstorming, asking questions, hypothesizing, predicting, categorizing, and inferring.

A rather large proportion of teachers, 62%, mentioned that the project had increased their understanding of the importance of making the purpose of the lesson known to the students.

Teachers developed class displays of the products of students' use of thinking skills. They claim to have observed an increased openness and curiosity in the children: better questions, more critical of their own work, increased thoroughness, a willingness to risk and increased ability to handle errors.

Students could identify fourteen different Skills of Thinking, mentioning brainstorming, hypothesizing, and questioning often. This confirms the opinion of the teachers. Some children claim they use thinking skills at home and at play, and the response of the parents lends some support to this claim.

With respect to the management of error, a school evaluation conducted "outside" of the project showed an interesting finding. Students and parents revealed a sense of freedom to make errors without fear of punishment. In the evaluation of one school in the project, when asked, "What do you like about this school?" parents and children replied, "When you make a mistake, no one gets mad." Teachers also report a decreased apprehension on the part of students about making errors.

Recommendations:

1.1. Teachers make clear to the children the thinking skills they are using: they name it, demonstrate its use, and recognize its use by the students.

1.2. Teachers develop procedures to evaluate and report on the use of thinking skills.

1.3. Teachers recognize the contribution which errors make to learning. See A Cognitive Model, Appendix E.

2. Research Question No.2: What does the Project teach about the introduction of new concepts or curricula into the schools?

Like many educational innovations, this one was initiated outside the classroom. The investigators recognized this and at least some of its limiting effects in the reactions of the teachers: resigned acceptance of another curricular project; implied suggestions that teachers were somehow unaware; the identification of the project as "theirs, not ours." It was perceived by some of the teachers as an add-on, although many acknowledged the need to teach thinking skills.

Two efforts to persuade teachers to endorse the project did not achieve complete success. Although each teacher received a copy of the research proposal, its arguments did not persuade the resistant. As another introductory device, all staff involved in the project received an invitation to a dinner. They received a brief explanation of the nature of the project, its goals, and how it would affect them. This aimed at removing uncertainties about its nature, and promised that the findings of the project, would in no way reflect upon their standing as a member on the staff. It sought to convey a respect of them and to enlist their support. It succeeded in large measure, although both efforts left persons feeling somewhat put upon.

Teachers participated in three in-service sessions. The first took the now classical form of bringing in the outside expert. This session, in the early months of the project had some shortcomings: for example, the presenter had a larger group that she preferred; she had too much to do in the time allotted; nevertheless, teachers found the presentation valuable and stimulating. The knowledge, conviction, and enthusiasm of the presenter brought people along.

In the second and third sessions, the teachers themselves conducted a large part of the in-service. When the time for these sessions had arrived, the interest and curiosity of the teachers led them to find out more about the subject; and having identified a particular interest, they felt confident enough to put on a demonstration of teaching some of the thinking skills for their colleagues.

Interestingly enough, even though the investigators considered the in-service sessions as important, and found those conducted by the teachers stimulating, only 30% of the teachers responding to the questionnaires found the in-services useful. The other 70% reported that they found handouts, manuals, books, audio and videotapes the most useful support.

The evidence raises the question, "Why did the Project gain less than complete support from the teachers?" After all, Alberta Education has proclaimed the importance of teaching thinking skills in its many documents. Educational literature affirms this. The Project itself focussed the attention of teachers on the subject.

The introduction and initial phases of the Project used the customary "quasi" professional development model. In this model the leadership is assumed by people other than the teachers. As the Project proceeded the investigators recognized the inherent weakness in this model, and sought to involve the professional skills of the teachers.

Recommendations:

The "Do-it-to-them" quasi professional in-service model used in this project did not meet expections. Effective educational innovation requires the modification of the customary in-service model and the adoption of one which recognizes and uses the professional competence of teachers - the "Do-it-by-them" model.

3. Research Question No. 3: What pertinence does the validated cognitive model have for classroom practice?

The Cognitive Model rescues the teacher from the abiding tyranny of the "fact" and the absolute requirement for the "right answer." An understanding of the model increases tolerance on the part of the teacher for ambiguity and the apparent irrelevance of an idea. It provides a structure for the admission of the irrelevant, apparently frivolous, or apparently incorrect response, because a persisting examination will decide their worth, rightness or value. In the meantime, these ideas may have unrealized value of their own.

Each mode of knowing in the cognitive model provides a framework for teachers in assisting students to manage information effectively, and to assist them in the development of a "Gestalt" for effectiveness in living.

For further explanation of the Cognitive Model, see Appendix E.

Recommendation:

The Committee on Thinking Skills established by Alberta Education consider adoption of the Cognitive Model.

4. Research Question No.4: In what ways can schools use the Measure of Questioning Skills?

For a full explanation of this instrument see Appendix F. Teachers interested in developing the ability of students to ask questions could use the measure in a pre- and post- test setting. The User's Guide provides a rationale and purpose statement; and it prescribes methods/techniques of teaching for questioning skills.

Recommendations:

1.1. Teachers use the Measure of Questioning Skills to develop the ability and raise the disposition of boys and girls to ask questions.

1.2. Teacher training programs consider the use of the Measure of Questioning Skills in developing an understanding of the importance of the disposition to ask a question.

5. Research Question No.5: Will the treatment group, (teachers and students, Grades 1-6 in Lethbridge Catholic Separate School District No.9) increase their scores on standardized tests as a result of professional development related to teaching thinking skills, more than the comparison group, (teachers and students, Grades 1-6, in Red Deer Catholic School District No.17) who received no such treatment?

The objective test data reported in Chapter Three indicates marginal differences between the treatment and the comparison group.

No significant differences were found in achievement as measured by the C.T.B.S. between the treatment and comparison groups. The objective data do not permit any generalizations about the effect of the treatment.

Selection of test instruments should match what is taught. For example, if questioning skills were taught, then an instrument that purports to assess the ability to question should be used.

The teachers and students found the amount of testing to be burdensome.

Recommendations:

1.1. The amount of testing be focused on the skills to be taught and the attitudes to be affected.

1.2. The research design used in a project should minimize the amount of testing with students and teachers.

Research Question No.6: What resources or information proved useful to teachers in developing their understanding and use of thinking skills in the classroom?

Over half of the teachers reported finding handouts, manuals, books, video and audiotapes useful. In addition, about one third stated that the in-service sessions were useful. Other teachers mentioned conferences, university courses and observation of the work of other teachers.

Recommendations:

A variety of methods be used in serving teacher needs with respect to educational innovation.

Additional Recommendations:

It is recommended that:

1. The purchase and use of thinking skills programs should occur after a school jurisdiction has examined ways of thinking that students need to develop. Consideration of teachers' skills and interests is important in selecting a program. Teachers, administators and supervisors need to be informed about them. A compilation of exemplary resources and addresses is found in Appendix G.

2. The Measure of Questioning Skills be normed on an adult population.

3. That the Student Evaluation and Records Branch of Alberta Education develop item typologies on the Achievement Tests and Diploma Examinations to illustrate the measurement of specific thinking skills and communicate these typologies to teachers.

4. Educators consider the concept of intelligence as behaviour that is skill - based and modifiable, as opposed to the thought that the limits of intelligence are set at birth and remain stable over time. In this connection, the authors changed the title of the project report to coincide with this recommendation.

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APPENDIX A

OBSERVATION SCHEDULE

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GENERAL OBSERVATIONS

The project on Thinking Skills is interesting, timely, and with proper follow-up can be very effective. I feel privileged to have played some part in it.

While I was making the classroom visits, the teachers and administrators in both Lethbridge and Red Deer were most cooperative. Every courtesy was extended to me which made my work more enjoyable and productive. I want to thank all the people with whom I worked for their cooperation and kindness. I enjoyed working on this project because I saw many examples of excellent teaching and learning.

Much of what I saw does not easily fit into the limited scope of the checklist used. For example, the teaching of values, development of habits and attitudes are not always taught in an overt manner and therefore do not lend themselves to classification of some specific thinking activity.

The checklist that was developed attempts to collect information on the types and frequency of activities that teach or promote thinking skills.

Student thinking occurs when the teacher is working on a one-to-one basis with a student. This is difficult for an observer to see and still remain unobtrusive. It is recognized that this very important aspect of teaching is not included in this survey.

It is further recognized that opportunities to include thinking activities vary widely from one subject to another and from one lesson to another in the same subject. However, it is contended that the sample taken is sufficiently broad to indicate a commonality of practice and upon which to base some recommendations for in-service or improvement.

It was not my prerogative to comment on the competence or effectiveness of the teachers. However, I was most impressed. The philosophy of the Catholic School System is manifested in a caring attitude and a concern for each child as a special creation of God.

Teacher's Name ______________________________ School ____________

Grade ______ Enrollment _______ Subject ____________ Date ________

CLASSROOM CLIMATE

	Poor				Excellent
	1	2	3	4	5
PREPARATION					
- secures students' attention					
- states objectives or purpose					
- presents rationale					
- reviews previous content					
- leads into present lesson					
- the students understand expectations					

ROUTINE ACTIVITIES

Routine activities are patterned and take a minimum of time

seating					
- getting materials					
- clean-up					

ENVIRONMENT

- supportive, warm, friendly					
- courteous to each other					
- time provided to think					
- students actively engaged					
- acceptance of student responses					
- praise and reinforcement					
- verbal interaction					

CONTINUUM OF THE EXTENT OF TEACHER CONTROL

complete teacher domination	students do entirely as they please

____

Global score for classroom climate

LETHBRIDGE CATHOLIC SEPARATE SCHOOL DISTRICT NO.9

TEACHER'S QUESTIONING TECHNIQUES

	Frequency Tally	
	Teacher	Student
1. Varies question levels		
- single answer, recall		
- examples		
- "why" or "how" questions		
- comparisons, similarities, differences		
- different points of view		
- application		
- conclusion		
2. Probes, re-phrases, prompts, pick up and extends from student responses.		
3. Waits for student responses, gives them time to think.		
4. Accepts and considers different points of view, uses errors as learning tools		
5. Provides answer to the question		
6. Asks process question - how did you get that answer ? - why did you change your minds?		
7. Stresses student understanding of meaning		
8. Total questions asked		

LETHBRIDGE CATHOLIC SEPARATE SCHOOL DISTRICT NO.9

ACTIVITIES THAT PROMOTE THINKING SKILLS

Frequency that the teacher requires the students to participate in	Activity	Frequency that students think by participating in
	questioning	
	describing	
	explaining	
	comparing	
	classifying	
	sequencing	
	expressing feelings stating opinion	
	summarizing	
	hypothesizing	
	predicting	
	logical reasoning	
	imagining	
	interpreting	
	evaluating	
	deciding	
	choosing	
(total)		(total)

taken from Language Arts Curriculum Guide

LETHBRIDGE CATHOLIC SEPARATE SCHOOL DISTRICT NO.9.

EXAMPLES OF CREATIVE THINKING

		Frequency Tally
1.	Openness to new ideas, don't stop when the first idea is presented, is this the only way, consider many alternatives, go beyond the known and familiar.	______
2.	Unconventional, original, different, seeing things in a new and different way, from a different mental or physical perspective.	______
3.	Brainstorming - individuals or in groups - list ideas, classify, add and delete, select	______
4.	Different predictions based on a variation of factors - what would happen if ...	______
5.	Speculation - what happened, why, what happened next, or before, in what ways might	______
6.	Fantasy - imagine yourself in another situation - real or improbable.	______
7.	Role playing, dramatization	______
8.	Know and express your feelings. How do you feel about ? Things that make you happy? sad? angry?	______
9.	Highlight the essence - simplify, clarify, condense, summarize.	______
10.	Analogies, parables.	______
11.	Humor, incongruities, surprise.	______

**

adapted from " Activities to Foster & Develop Creativity"
G. Millar - editor.

APPENDIX B

Questionnaire for Teachers, Students, Parents and Principals

LETHBRIDGE CATHOLIC SEPARATE SCHOOL
DISTRICT NO. 9
534 - 18th STREET SOUTH LETHBRIDGE, ALBERTA T1J 3E7
TELEPHONE (403) 329-0365

Dear Parents and Guardians:

Since September of 1985, our schools have had a concern about teaching what we call Thinking Skills to the children. Our aim: to teach children to use and understand certain Thinking Skills. We want to know what effects, if any, our efforts have had.

Have you seen or heard any evidence of these efforts in your child's work or behaviour?

YES ____ **NO** ____

If "yes" please describe what you have seen or heard.

Please have your child take this slip back to the school right away.

LETHBRIDGE CATHOLIC SEPARATE SCHOOL
DISTRICT NO. 9
534 - 18th STREET SOUTH LETHBRIDGE, ALBERTA T1J 3E7
TELEPHONE (403) 329-0365

1987 03 06

THINKING SKILLS PROJECT

STUDENT QUESTIONNAIRE

1. What thinking skills can you name?

2. What thinking skills have you used in your work at school?

3. What thinking skills have you used at home?

4. What thinking skills have you used at play?

LETHBRIDGE CATHOLIC SEPARATE SCHOOL
DISTRICT NO. 9
534 - 18th STREET SOUTH LETHBRIDGE, ALBERTA T1J 3E7
TELEPHONE (403) 329-0365

1987 03 06

THINKING SKILLS (SKILLS OF INTELLIGENCE) PROJECT

TEACHERS' QUESTIONNAIRE

1. How has the Thinking Skills project affected your teaching?

2. What Thinking Skills have you used explicitly in your teaching as a result of the project?

3. What effects of the Thinking Skills project have you observed in the work of your students?

4. How can a teacher give recognition to students for the use of Thinking Skills?

5. What resources or information on Thinking Skills did you find useful in understanding Thinking Skills and their application in the classroom?

6. On a 5 point scale, rate the effectiveness of the Thinking Skills project in influencing your teaching.

   1 2 3 4 5

   Low High

   Identify a strength of the project.

   Identify a weakness of the project.

7. What recommendations have you for further action?

APPENDIX C

DESCRIPTIVE STATISTICS

FOR ALL STUDENTS IN PROJECT

Pre-test

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TABLE A

Means and Standard Deviations of Grades 1,2 and 3 Students' Pretest Scores

	Lethbridge									Red Deer								
Grade	1			2			3			1			2			3		
Measure	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.
Canadian Test of Basic Skills (Total-Raw Scores)	46	125.70	14.51	52	259.12	44.49	35	279.49	30.85	27	134.00	7.15	34	268.26	37.00	42	283.69	49.05
Security Tests																		
Security	47	56.28	8.29	53	63.02	12.31	38	69.69	9.12	26	64.62	11.83	37	66.64	10.84	40	74.12	7.67
Consistency	47	13.04	10.61	53	20.11	16.95	38	29.99	18.32	26	25.77	17.36	37	23.86	16.82	40	36.03	13.99
Torrance Tests of Creative Thinking																		
Total	47	95.59	9.79	54	93.92	10.27	37	93.31	11.63	26	103.35	13.70	40	98.57	10.22	47	98.66	8.62
Fluency	47	95.02	25.12	54	91.87	22.61	37	99.49	15.85	26	107.62	26.18	40	101.75	32.95	47	102.45	22.53
Originality	47	119.45	22.54	54	106.93	25.25	37	108.51	31.87	26	118.77	36.96	40	122.38	30.63	47	112.57	24.97
Titles	47	99.06	15.31	54	106.80	24.68	37	101.78	15.02	26	118.38	34.72	40	102.52	18.08	47	105.09	15.25
Elaboration	47	79.02	8.28	54	79.69	11.62	37	80.70	10.42	26	86.15	18.49	40	79.15	11.43	47	80.47	12.33
Resistance to Closure	47	85.38	15.13	54	84.31	14.66	37	76.05	16.49	26	85.81	16.50	40	87.05	17.13	47	92.74	14.74

TABLE B

Means and Standard Deviations of Grades 4 and 5 Students' Pretest Scores

	Lethbridge						Red Deer					
Grade	4			5			4			5		
Measure	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.
Canadian Test of Basic Skills (Total-Raw Scores)	44	182.45	67.50	55	222.89	61.46		n/a		32	233.66	56.16
Security Tests												
Security	47	62.52	11.17	59	71.34	11.86		n/a		35	68.70	14.62
Consistency	47	16.64	14.01	59	31.20	16.54		n/a		35	29.99	20.99
School Subjects Attitude Scales *												
Mathematics		n/a		50	4.10	0.78		n/a		28	3.76	0.79
Language Arts		n/a		46	3.94	0.49		n/a		25	3.56	0.61
Torrance Tests of Creative Thinking (Standard Scores)												
Total	48	92.26	12.26	59	93.92	12.48		n/a		35	97.24	10.39
Fluency	48	89.42	20.97	59	90.58	23.87		n/a		35	92.77	19.56
Originality	48	110.83	23.57	59	109.47	21.41		n/a		35	124.66	20.99
Titles	48	98.46	15.55	59	104.83	13.36		n/a		35	104.14	14.42
Elaboration	48	77.67	10.87	59	81.12	11.63		n/a		35	77.91	8.87
Resistance to Closure	48	84.94	10.91	59	83.61	20.48		n/a		35	86.71	16.32

* Based on responses to a 5-point scale, where 5=most positive response and 1=least positive response.

TABLE C

Means of Students' Pretest Raw Scores - Canadian Test of Basic Skills

Lethbridge

		Level 5	Level 7/8			Level 10/11		
	Grade	1	2	3	Total	4	5	Total
Listening	X̄	24.43	22.13	21.51	21.88	-	-	-
	N	47	55	37	92	-	-	-
Vocabulary	X̄	23.04	18.49	20.49	19.29	20.06	24.00	22.23
	N	46	55	37	92	48	59	107
Reading	X̄	-	-	-	-	21.31	28.05	24.97
	N	-	-	-	-	48	57	105
Word	X̄	26.89	36.62	36.19	36.45	-	-	-
	N	47	55	37	92	-	-	-
Language	X̄	24.60	-	-	-	-	-	-
	N	47	-	-	-	-	-	-
Mathematics	X̄	26.72	-	-	-	-	-	-
	N	47	-	-	-	-	-	-
Reading Total	X̄	-	85.70	89.37	87.16	-	-	-
	N	-	53	35	88	-	-	-
Work Study Total	X̄	-	41.06	50.68	44.97	40.31	46.83	43.88
	N	-	54	37	91	48	58	106
Math Total	X̄	-	57.42	59.32	58.18	41.89	53.10	48.14
	N	-	55	37	92	46	58	104
Language Total	X̄	-	-	-	-	59.33	72.24	66.58
	N	-	-	-	-	46	59	105
Total	X̄	125.70	259.12	279.49	267.31	182.45	222.89	204.92
	N	46	52	35	87	44	55	99

TABLE C (continued)

Red Deer

		Level 5	Level 7/8			Level 10/11		
Grade		1	2	3	Total	4	5	Total
Listening	$\bar{X}$	26.11	23.70	22.37	22.99	-	-	-
	N	27	40	46	86	-	-	-
Vocabulary	$\bar{X}$	25.00	18.81	21.67	20.40	n/a	25.41	25.41
	N	27	37	46	83		34	34
Reading	$\bar{X}$	-	-	-	-	n/a	28.82	28.82
	N	-	-	-	-		34	.34
Word	$\bar{X}$	29.85	36.42	37.83	37.19	-	-	-
	N	27	38	46	84	-	-	-
Language	$\bar{X}$	25.89	-	-	-	-	-	-
	N	27	-	-	-	-	-	-
Mathematics	$\bar{X}$	27.15	-	-	-	-	-	-
	N	27	-	-	-	-	-	-
Reading Total	$\bar{X}$	-	89.08	90.86	90.05	-	-	-
	N	-	36	43	79	-	-	-
Work Study Total	$\bar{X}$	-	43.37	51.85	48.01	n/a	48.47	48.47
	N	-	38	46	84		34	34
Math Total	$\bar{X}$	-	56.03	58.50	57.40	n/a	54.94	54.94
	N	-	37	46	83		34	34
Language Total	$\bar{X}$	-	-	-	-	n/a	79.77	79.77
	N	-	-	-	-		35	35
Total	$\bar{X}$	134.00	268.26	283.69	276.79	n/a	233.66	233.66
	N	27	34	42	76		32	32

TABLE D

Means of Students' Pretest Scores - Security Test

Lethbridge

		Tommy				Jimmy		
Grade		1	2	3	Total	4	5	Total
Security (SS)	$\bar{X}$	56.28	63.02	69.69	62.56	62.52	71.34	67.43
	N	47	53	38	138	47	59	106
Consistency (CS)	$\bar{X}$	13.04	20.11	29.99	20.42	16.64	31.20	24.74
	N	47	53	38	138	47	59	106
Independent Security (IS)	$\bar{X}$	27.30	25.30	23.50	25.49	38.51	33.34	35.63
	N	47	53	38	138	47	59	106
Mature Dependent Security(MDS)	$\bar{X}$	-	-	-	-	38.62	33.25	35.63
	N					47	59	106
Immature Dependent Security(IDS)	$\bar{X}$	29.36	26.94	24.00	26.96	45.79	47.93	46.98
	N	47	53	38	138	47	59	106
Deputy Agent (DA)	$\bar{X}$	31.85	34.58	37.87	34.56	50.98	57.00	54.33
	N	47	53	38	138	47	59	106
Insecurity (INS)	$\bar{X}$	31.49	33.17	34.63	33.00	51.11	53.47	52.42
	N	47	53	38	138	47	59	106

Red Deer

		Tommy				Jimmy		
Grade		1	2	3	Total	4	5	Total
Security (SS)	$\bar{X}$	64.62	66.64	74.12	69.04	n/a	68.70	68.70
	N	26	37	40	103		35	35
Consistency (CS)	$\bar{X}$	25.77	23.86	36.03	29.07	n/a	29.99	29.99
	N	26	37	40	103		35	35
Independent Security (IS)	$\bar{X}$	25.81	25.70	22.50	24.49	n/a	33.54	33.54
	N	26	37	40	103		35	35
Mature Dependent Security(MDS)	$\bar{X}$	-	-	-	-	n/a	36.00	36.00
	N						35	35
Immature Dependent Security(IDS)	$\bar{X}$	24.46	24.49	22.92	23.87	n/a	47.86	47.86
	N	26	37	40	103		35	35
Deputy Agent (DA)	$\bar{X}$	36.12	33.95	37.70	35.95	n/a	56.00	56.00
	N	26	37	40	103		35	35
Insecurity (INS)	$\bar{X}$	33.62	35.86	36.88	35.69	n/a	51.60	51.60
	N	26	37	40	103		35	35

TABLE E

Means of Grade 5 Students' Pretest Scores - School Subjects Attitude Scales

	Lethbridge			Red Deer		
	N	$\bar{X}$	SD	N	$\bar{X}$	SD
Mathematics	50	4.10	0.78	28	3.76	0.79
Evaluation	57	4.12	1.14	31	3.66	1.32
Usefulness	53	4.60	0.63	31	4.42	0.75
Difficulty	54	3.48	0.80	30	3.19	0.83
Language Arts	46	3.94	0.49	25	3.56	0.61
Evaluation	54	3.86	0.74	31	3.35	0.85
Usefulness	50	4.42	0.52	29	4.10	0.94
Difficulty	52	3.51	0.71	29	3.37	0.72

* Based on responses to a 5-point scale, where 5=most positive response and 1=least positive response.

TABLE F

Means of Students' Pretest Standard Scores - Torrance Tests of Creative Thinking

Lethbridge

Grade		1	2	3	4	5	Total
Fluency	$\bar{X}$	95.02	91.87	99.49	89.42	90.58	92.83
	N	47	54	37	48	59	245
Originality	$\bar{X}$	119.45	106.93	108.51	110.83	109.47	110.95
	N	47	54	37	48	59	245
Titles	$\bar{X}$	99.06	106.80	101.78	98.46	104.83	102.45
	N	47	54	37	48	59	245
Elaboration	$\bar{X}$	79.02	79.69	80.70	77.67	81.12	79.66
	N	47	54	37	48	59	245
Resistance to closure	$\bar{X}$	85.38	84.31	76.05	84.94	83.61	83.22
	N	47	54	37	48	59	245
Total	$\bar{X}$	95.59	93.92	93.31	92.26	93.92	93.82
	N	47	54	37	48	59	245

Red Deer

Grade		1	2	3	4	5	Total
Fluency	$\bar{X}$	107.62	101.75	102.45	n/a	92.77	100.88
	N	26	40	47		35	148
Originality	$\bar{X}$	118.77	122.38	112.57	n/a	124.66	119.17
	N	26	40	47		35	148
Titles	$\bar{X}$	118.38	102.52	105.09	n/a	104.14	106.51
	N	26	40	47		35	148
Elaboration	$\bar{X}$	86.15	79.15	80.47	n/a	77.91	80.51
	N	26	40	47		35	148
Resistance to closure	$\bar{X}$	85.81	87.05	92.74	n/a	86.71	88.56
	N	26	40	47		35	148
Total	$\bar{X}$	103.35	98.57	98.66	n/a	97.24	99.12
	N	26	40	47		35	148

TABLE G

Summary of Teacher Pretest Classification - Human Information Processing Survey

Lethbridge

Grade	Overall		1		2		3		4		5	
	N	%	N	%	N	%	N	%	N	%	N	%
Left	3	15	1	5	1	5	0	0	0	0	1	5
Integrated	2	10	0	0	0	0	1	5	1	5	0	0
Right	5	25	0	0	1	5	0	0	2	10	2	10
Mixed	10	50	3	15	2	10	2	10	1	5	2	10
	20	100	4	20	4	20	3	15	4	20	5	25

Red Deer

Grade	Overall		1		2		3		4		5	
	N	%	N	%	N	%	N	%	N	%	N	%
Left	1	7	0	0	0	0	0	0	n/a	n/a	1	7
Integrated	6	43	0	0	1	7	3	21	n/a	n/a	2	14
Right	0	0	0	0	0	0	0	0	n/a	n/a	0	0
Mixed	7	50	3	21	3	21	1	7	n/a	n/a	0	0
	14	100	3	21	4	29	4	29	n/a	n/a	3	21

TABLE H

Means and Standard Deviations of Teachers' Pretest Standard Scores - Torrance Tests of Creative Thinking

	Lethbridge			Red Deer		
	N	$\overline{X}$	SD	N	$\overline{X}$	SD
Total	20	93.33	14.52	12	98.75	7.39
Fluency	20	97.10	17.22	12	94.92	12.03
Originality	20	121.35	26.81	12	132.83	24.98
Titles	20	96.70	22.69	12	101.33	14.43
Elaboration	20	73.00	15.88	12	73.92	12.12
Resistance to closure	20	78.50	15.14	12	90.75	11.31

TABLE I

Means of Teachers' Pretest Standard Scores - Torrance Tests of Creative Thinking by Grade Level

Lethbridge

Grade		1	2	3	4	5	Total
Fluency	$\bar{X}$	111.00	94.25	113.00	86.50	87.20	97.10
	N	4	4	3	4	5	20
Originality	$\bar{X}$	149.50	109.75	107.67	119.50	117.80	121.35
	N	4	4	3	4	5	20
Titles	$\bar{X}$	112.00	107.00	85.00	94.50	85.00	96.70
	N	4	4	3	4	5	20
Elaboration	$\bar{X}$	88.00	65.00	70.67	70.75	70.60	73.00
	N	4	4	3	4	5	20
Resistance to closure	$\bar{X}$	93.25	74.50	68.67	78.25	76.00	78.50
	N	4	4	3	4	5	20
Total	$\bar{X}$	110.75	90.10	89.00	89.90	87.32	93.33
	N	4	4	3	4	5	20

Red Deer

Grade		1	2	3	4	5	Total
Fluency	$\bar{X}$	87.67	94.50	92.00	n/a	111.00	94.92
	N	3	4	3		2	12
Originality	$\bar{X}$	120.33	136.25	121.67	n/a	161.50	132.83
	N	3	4	3		2	12
Titles	$\bar{X}$	113.00	93.25	99.00	n/a	103.50	101.33
	N	3	4	3		2	12
Elaboration	$\bar{X}$	73.33	78.75	65.33	n/a	78.00	73.92
	N	3	4	3		2	12
Resistance to closure	—	90.33	83.25	93.67	n/a	102.00	90.75
	N	3	4	3		2	12
Total	$\bar{X}$	96.93	97.20	94.33	n/a	111.20	98.75
	N	3	4	3		2	12

APPENDIX D

DESCRIPTIVE STATISTICS

FOR ALL STUDENTS IN PROJECT

Post-test

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TABLE J

Means of Students' Raw Posttest Scores - Canadian Test of Basic Skills

Lethbridge

		Level 5	Level 7/8			Level 10/11		
Grade		1	2	3	Total	4	5	Total
Listening	$\bar{X}$	25.63	22.98	24.86	23.96	-	-	-
	N	41	47	51	98	-	-	-
Vocabulary	$\bar{X}$	25.55	22.82	22.84	22.83	23.00	n/a	23.00
	N	40	45	51	96	52	n/a	52
Reading	$\bar{X}$	-	-	-	-	22.83	n/a	22.83
	N	-	-	-	-	52	n/a	52
Word	$\bar{X}$	31.65	38.32	40.27	39.34	-	-	-
	N	40	47	51	98	-	-	-
Language	$\bar{X}$	26.64	-	-	-	-	-	-
	N	39	-	-	-	-	-	-
Mathematics	$\bar{X}$	29.26	-	-	-	-	-	-
	N	39	-	-	-	-	-	-
Reading Total	$\bar{X}$	-	94.75	98.04	96.52	-	-	-
	N	-	44	51	95	-	-	-
Work Study Total	$\bar{X}$	-	47.40	57.39	52.71	43.58	n/a	43.58
	N	-	45	51	96	52	n/a	52
Mathematics Total	$\bar{X}$	-	65.84	68.98	67.54	54.10	n/a	54.10
	N	-	43	51	94	52	n/a	52
Language Total	$\bar{X}$	-	-	-	-	69.35	n/a	69.35
	N	-	-	-	-	52	n/a	52
Total	$\bar{X}$	139.21	295.00	312.39	304.54	212.85	n/a	212.85
	N	38	42	51	93	52	n/a	52

TABLE J (continued)

Red Deer

		Level 5	Level 7/8			Level 10/11		
Grade		1	2	3	Total	4	5	Total
Listening	$\bar{X}$	26.39	23.61	-	23.61	-	-	-
	N	33	41	-	41	-	-	-
Vocabulary	$\bar{X}$	25.36	21.57	-	21.57	n/a	n/a	n/a
	N	33	42	-	42	n/a	n/a	n/a
Reading	$\bar{X}$	-	-	-	-	n/a	n/a	n/a
	N	-	-	-	-	n/a	n/a	n/a
Word	$\bar{X}$	32.76	41.18	-	41.18	-	-	-
	N	33	40	-	40	-	-	-
Language	$\bar{X}$	27.09	-	-	-	-	-	-
	N	33	-	-	-	-	-	-
Mathematics	$\bar{X}$	29.12	-	-	-	-	-	-
	N	33	-	-	-	-	-	-
Reading Total	$\bar{X}$	-	99.86	-	99.86	-	-	-
	N	-	36	-	36	-	-	-
Work Study Total	$\bar{X}$	-	49.58	-	49.58	n/a	n/a	n/a
	N	-	43	-	43	n/a	n/a	n/a
Mathematics Total	$\bar{X}$	-	66.98	-	66.98	n/a	n/a	n/a
	N	-	42	-	42	n/a	n/a	n/a
Language Total	$\bar{X}$	-	-	-	-	n/a	n/a	n/a
	N	-	-	-	-	n/a	n/a	n/a
Total	$\bar{X}$	140.73	307.85	-	307.85	n/a	n/a	n/a
	N	33	34	-	34	n/a	n/a	n/a

TABLE K

Mean of Students' Posttest Scores - Security Test

Lethbridge

		Tommy				Jimmy		
Grade		1	2	3	Total	4	5	Total
Security (SS)	$\bar{X}$	60.51	72.31	75.22	69.86	66.58	74.07	70.29
	N	41	47	50	138	51	50	101
Consistency (CS)	$\bar{X}$	18.36	33.84	38.95	31.09	25.12	34.45	29.74
	N	41	47	50	138	51	50	101
Independent Security (IS)	$\bar{X}$	26.37	22.98	21.28	23.37	35.61	31.14	33.40
	N	41	47	50	138	51	50	101
Mature Dependent Security(MDS)	$\bar{X}$	-	-	-	-	36.45	32.60	34.54
	N	-	-	-	-	51	50	101
Immature Dependent Security(IDS)	$\bar{X}$	27.17	23.87	24.14	24.95	47.41	48.84	48.12
	N	41	47	50	138	51	50	101
Deputy Agent (DA)	$\bar{X}$	33.95	36.55	37.62	36.17	53.65	57.76	55.68
	N	41	47	50	138	51	50	101
Insecurity (INS)	$\bar{X}$	32.51	36.60	36.96	35.51	51.88	54.66	53.26
	N	41	47	50	138	51	50	101

Red Deer

		Tommy				Jimmy		
Grade		1	2	3	Total	4	5	Total
Security (SS)	$\bar{X}$	65.51	68.29	78.22	69.71	n/a	64.98	64.98
	N	33	40	23	96	n/a	75	75
Consistency (CS)	$\bar{X}$	20.43	28.81	47.16	30.33	n/a	22.15	22.15
	N	33	40	23	96	n/a	75	75
Independent Security (IS)	$\bar{X}$	24.94	24.93	21.17	24.03	n/a	37.16	37.16
	N	33	40	23	96	n/a	75	75
Mature Dependent Security(MDS)	$\bar{X}$	-	-	-	-	n/a	37.09	37.09
	N	-	-	-	-	n/a	75	75
Immature Dependent Security(IDS)	$\bar{X}$	25.55	23.75	21.35	23.79	n/a	45.76	45.76
	N	33	40	23	96	n/a	75	75
Deputy Agent (DA)	$\bar{X}$	35.48	35.77	39.91	36.67	n/a	53.63	53.63
	N	33	40	23	96	n/a	75	75
Insecurity (INS)	$\bar{X}$	34.03	35.55	37.57	35.51	n/a	51.36	51.36
	N	33	40	23	96	n/a	75	75

TABLE L

Means of Grade 5 Students' Posttest Scores - School Subjects Attitude Scale

	Lethbridge			Red Deer		
	N	$\bar{X}$	SD	N	$\bar{X}$	SD
Mathematics	42	4.28	0.37	62	3.32	0.82
Evaluation	49	4.33	0.59	71	2.81	1.21
Usefulness	44	4.73	0.31	67	4.08	1.11
Difficulty	47	3.78	0.59	67	3.17	0.78
Language Arts	41	4.00	0.45	59	3.65	0.92
Evaluation	48	3.79	0.76	71	3.62	1.10
Usefulness	46	4.44	0.43	68	3.93	1.12
Difficulty	46	3.70	0.64	66	3.40	0.85

* Based on responses to a 5-point scale, where 5=most positive response and 1=least positive response.

TABLE M

Means of Students' Posttest Standard Scores - Torrance Tests of Creative Thinking

Lethbridge

Grade		1	2	3	4	5	Total
Fluency	$\overline{X}$	87.43	110.85	97.39	95.52	84.22	95.27
	N	40	47	51	54	49	241
Originality	$\overline{X}$	113.78	114.62	121.37	103.26	108.39	112.10
	N	40	47	51	54	49	241
Titles	$\overline{X}$	92.78	107.74	109.69	99.50	105.51	103.37
	N	40	47	51	54	49	241
Elaboration	$\overline{X}$	74.35	81.70	86.71	76.94	74.55	79.02
	N	40	47	51	54	49	241
Resistance to closure	$\overline{X}$	87.63	91.38	89.94	86.61	85.37	88.16
	N	40	47	51	54	49	241
Total	$\overline{X}$	91.19	101.26	101.02	92.37	91.61	95.58
		40	47	51	54	49	241

Red Deer

Grade		1	2	3	4	5	Total
Fluency	$\overline{X}$	87.68	87.19	92.50	n/a	88.79	88.71
	N	31	43	24	n/a	75	173
Originality	$\overline{X}$	109.16	118.79	136.13	n/a	112.35	116.68
	N	31	43	24	n/a	75	173
Titles	$\overline{X}$	116.71	117.93	115.50	n/a	108.87	113.45
	N	31	43	24	n/a	75	173
Elaboration	$\overline{X}$	87.87	79.26	81.33	n/a	77.84	80.47
	N	31	43	24	n/a	75	173
Resistance to closure	$\overline{X}$	94.13	93.47	95.75	n/a	87.77	91.43
	N	31	43	24	n/a	75	173
Total	$\overline{X}$	99.11	99.33	104.24	n/a	95.12	98.15
	N	31	43	24	n/a	75	173

TABLE N

Summary of Teacher Postest Classification - Human Information Processing Survey

	Lethbridge		Red Deer	
	N	%	N	%
Left	0	0	1	14.3
Integrated	2	20	3	42.8
Right	4	40	0	0.0
Mixed	4	40	3	42.8
	10	100	7	99.9

TABLE O

Means and Standard Deviations of Teachers' Posttest Standard Scores - Torrance Tests of Creative Thinking

	Lethbridge			Red Deer		
Measure	N	$\overline{X}$	SD	N	$\overline{X}$	SD
Total	10	97.50	11.94	7	99.74	5.33
Fluency	10	89.60	11.79	7	92.86	10.38
Originality	10	135.60	26.57	7	133.71	16.44
Titles	10	107.40	16.37	7	103.71	18.67
Elaboration	10	68.40	10.16	7	68.57	7.39
Resistance to closure	10	86.50	18.48	7	99.86	15.77

TABLE P

Means of Teachers' Posttest Standard Scores - Torrance Tests of Creative Thinking

Lethbridge

Grade		1	2	3	4	5	Total
Fluency	$\bar{X}$	95.00	83.00	85.50	87.00	97.50	89.60
	N	2	2	2	2	2	10
Originality	$\bar{X}$	155.50	127.00	135.00	113.00	147.50	135.60
	N	2	2	2	2	2	10
Titles	$\bar{X}$	120.00	101.50	117.50	92.00	106.00	107.40
	N	2	2	2	2	2	10
Elaboration	$\bar{X}$	74.50	63.00	59.50	74.50	70.50	68.40
	N	2	2	2	2	2	10
Resistance to closure	$\bar{X}$	92.00	94.50	77.00	74.50	94.50	86.50
	N	2	2	2	2	2	10
Total	$\bar{X}$	107.40	93.80	94.90	88.20	103.20	97.50
	N	2	2	2	2	2	10

Red Deer

Grade		1	2	3	4	5	Total
Fluency	$\bar{X}$	99.00	95.00	-	n/a	87.33	92.86
	N	2	2	-	n/a	3	7
Originality	$\bar{X}$	139.00	149.00	-	n/a	120.00	133.71
	N	2	2	-	n/a	3	7
Titles	$\bar{X}$	92.00	104.00	-	n/a	111.33	103.71
	N	2	2	-	n/a	3	7
Elaboration	$\bar{X}$	67.00	74.50	-	n/a	65.67	68.57
	N	2	2	-	n/a	3	7
Resistance to closure	$\bar{X}$	99.50	102.00	-	n/a	98.67	99.86
	N	2	2	-	n/a	3	7
Total	$\bar{X}$	99.30	104.90	-	n/a	96.60	99.74
	N	2	2	-	n/a	3	7

APPENDIX E

A COGNITIVE MODEL

TATAT: A COGNITIVE MODEL FOR TEACHERS

Thinking About Teaching About Thinking

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Introduction

If questioned on the matter of a "cognitive model", many of us would spurn such a challenge, borrow from Shakespeare's Antony and say, "I only teach right on." But persistent enquiry would erode this assertion of plainness and find more sophistication than the five simple words confess. For example, most people know of Bloom's Taxomony and its three domains, of which the cognitive has proved most satisfying. And curriculum makers find comfort in reference to another model in the terms "content and process" as ways of examining the cognitive. In other words, whether or not teachers have a cognitive model, something more than whim guides their work.

The merit of a model lies in its simplicity; therein lies its problem: a model represents a complex phenomenon in a simplified, graphic form. In the cognitive model described below, a static form represents ways of knowing. The model appears to give a balance between the essential ways of knowing; however, in reality the balance and relationship between the two, varies with individuals, their intellectual development, interests and motivation. The model works better, if the reader imagines the relative sizes of the cubes as changeable.

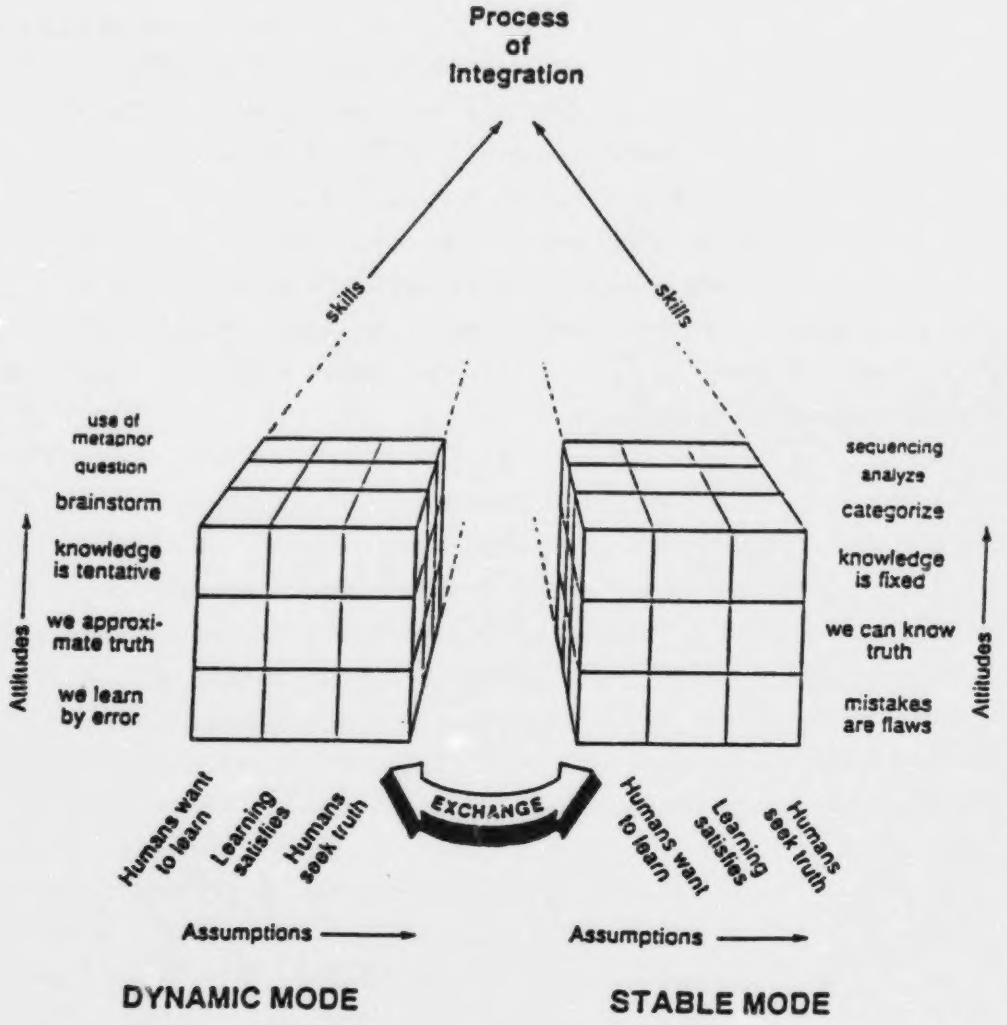
The purpose of this paper is to provide a rationale for the teaching of the skills of thinking. The paper assumes two major modes of thinking which are called Stable and Dynamic.

Attributes of A Cognitive Model

Figure 1 sets out two ways or modes of knowing; a stable mode and a dynamic mode. Each mode has the same three dimensions: assumptions about learning, attitudes towards learning, and skills of learning. These three dimensions provide an operational definition for knowledge in each of the two modes.

Figure 1

A COGNITIVE MODEL


Process of Integration
Skills
Skills
use of metaphor
question
brainstorm
knowledge is tentative
we approximate truth
we learn by error
Attitudes
sequencing
analyze
categorize
knowledge is fixed
we can know truth
mistakes are flaws
Attitudes
Humans want to learn
Learning satisfies
Humans seek truth
EXCHANGE
Humans want to learn
Learning satisfies
Humans seek truth
Assumptions
Assumptions
DYNAMIC MODE
STABLE MODE

1986 © Ralph Himsel, Garnet Millar

The two modes have common assumptions about the disposition of people towards learning: they seek truth; they want to learn; and learning satisfies. The attitudes toward error, truth and knowledge and related skills distinguish one mode form the other. The exchange arrow denotes the flow of ideas from one mode to the other. The process of integration combines the distinctive workings of the two modes - Stable and Dynamic.

The Stable Mode

In schools, we direct much of our teaching to the Stable Mode, and much of students' learning is centred in the Stable Mode. In this component of the model, errors count as mistakes. In the Stable Mode, two and two make four. Any other sum means an error. The sun must "rise" each day; any claim to the contrary upsets people and marks the person as unbalanced in some way, prone to error in basic matters; society reserves a particular scorn for people who believe we live on a flat earth, because our knowledge in the stable mode, has it that we live on a sphere. Our psychological well-being requires a knowledge of a large store of what some people call "true facts". These facts accumulate to make what we know as truth. In the stable mode, we have truth and furthermore, we can know truth.

Society has a parallel to this stable mode, as if responding to the need of individuals for stability. Churches, the system of laws, financial institutions, the family unit, schools, governments, customs, language, and police forces all have a stabilizing, or conserving function. Standing on a basis of this sort, a society can handle a strong current of invention and development or dynamism - the products of entrepreneurs, scientists, scholars, theologians, artists, inventors and social reformers. Clearly, we need to teach for learning in the Stable Mode.

Skills of the Stable Mode

The stable mode has a set of skills appropriate to the assumptions about and attitudes toward learning: some types of questioning, categorizing, planning, counting, measuring, model making, logical reasoning, deducing, memorizing, accounting, recording, sequencing. All skills of great power. Children need to know them; the school has done much to teach them.

The Dynamic Mode

The attitudes characteristic of the dynamic mode permit a view of knowledge marked by action and movement. In contrast to the view of error as flaws, characteristic of the stable mode, in the dynamic mode, errors point the seeker to truth. The student looks at the mistake and in a moment of self-communion says, "I missed there, but I'll keep on looking". In the dynamic mode, errors do not reflect on the person who made them; errors inevitably mark the path to discovery. Dared one ascribe a purpose to errors in the dynamic mode, that purpose would be to direct the person to truth.

In the dynamic mode we do not get to know truth; perhaps at best, we approximate it. And so we account for the vulnerability of scientific theories to the test of diligent enquiry; those theories, crouch in a kind of apprehension lest this new test prove them inadequate, wrong or in error. Each new test takes us nearer the truth, but each step closer, falls short of full realization of truth.

Skills of the Dynamic Mode

Like the stable mode, the dynamic mode has a set of skills appropriate to it; the skills customarily associated with creativity. Dr. E. Paul Torrance, distinguished researcher in the area creativity, asserts that "You need courage to be creative. Just as soon as you have a new idea, you are in a minority of one. And being in a minority of one is uncomfortable - it takes courage." (1971).

Figure 1 lists skills such as the familiar brainstorming technique, questioning, use of metaphor, incubating, guessing, imagining, hypothesis making, synthesizing, use of paradox, compromising, reversing, tentativeness, tolerance for ambiguity and speculating. These skills can move and create ideas and though in a constructive manner.

The skill of questioning needs a little more examination. Some kinds of questioning belong in the stable mode. Who, what, where, when, why and how, for example: the "six friends" of Rudyard Kipling belong in the stable mode, because the answers to those questions describe things as they are. Two additions to this set of six questions, whext and whif, move the questioning process into the dynamic mode. "Whext" and "whif" have no acceptance in the English language; suffice it to say that they stand for two powerful additions to the questioning process. "Whext" means what next and invites the elegant thinking act of hypothesis formation as a response. "Whif" represents an equally strong idea; it means what if. What would happen to a particular system if we altered a certain factor? "Whif" looks like a first step to invention itself.

The "Exchange Arrow" in the Cognitive Model

The productive person integrates the process of knowing in each of the modes. Everybody in good mental health has a set of concepts, behaviours and attitudes which they hold more or less tenaciously. These "certainties" provide a secure base which enables persons to carry out the experiments, speculations and adventures implied in the actions of the dynamic mode. By and by, the actions of the dynamic mode uncover or invent new ideas which the person accepts and assigns them a place in the stable mode. In other words, learning has taken place.

Something like the following seems to take place which is represented by the "exchange arrow": a signal goes from the stable mode to the dynamic mode that the person has a strong hold on some "certainties" permitting adventures into the unknown, the ridiculous, or the speculative. For its part, the dynamic mode feeds its discoveries through the exchange arrow to the stable mode where these new ideas must pass the test of the deliberate work of the stable mode.

By virtue of these complementary actions of the two modes and the communication represented by the exchange arrow, the learning individual moves toward an integration of new knowledge. In brainstorming, for example, the participants working in the Stable Mode, identify a problem, such as: In what ways can we persuade smokers to stop smoking? In search of solutions, the participants abandon the patterns of the stable mode, and venture willy-nilly into the almost frivolous, for example, Smoke gets in your eyes; smoking lowers your IQ; my mom won't like it; dirties my teeth. They suspend the critical faculty and produce recklessly: they combine, enlarge, eliminate, minify, elaborate, reverse, etc. to move ideas into new structures. After a period of such free association, the results are sorted and confirmed by the critical faculties of the Stable Mode.

Implications of the Model for Teaching and Learning

The model rationalizes the relationship between the skills of intelligence from both modes which schools need to teach children. It demonstrates the complementary nature of the sets of skills from both modes.

The model implies that individuals need the ability to operate in both modes; it implies that in teaching the whole child, the teacher will teach to both modes: now to the stable, and now to the dynamic. The exchange arrow indicates the continuous flow between the two ways of knowing.

Teaching in the dynamic mode uses a different vocabulary from teaching in the stable mode. When teachers want their students to work in the dynamic mode, they say things like "How many ideas can we get? Make a guess. How many ways can you arrange these groups of pebbles? Perhaps we cannot get any closer to the answer. Can you see a pattern? What if we change this?" The dynamic mode tends to shun use of the verb "to be". The teacher takes on the role of facilitator in the dynamic mode. On the other hand, teaching in the stable mode, teachers use words like, "What criteria can we develop? What elements do you discern in this composition? Arrange the pebbles on your desk, smallest to the largest, left to right". In either mode, a question asked by the students becomes as important as a question answered.

The shield in Figure 2 expresses in classical form, some aspects of questioning and helps fix them in our minds and those of our children. The eight question marks, across the uppoer third of the crest, represent who, what, where, when, why, how, "whext" and "whif" mentioned earlier.

The Lynx canadensis in the middle of the shield has a proper stance for questions. Heraldic people call this the gardant position. Like any good questioner, this cat looks directly into the world with an unflinching gaze, ready to examine any proposition with a well placed enquiry. The right paw, cocked in its equivocal way, will knock the answer away if it does not suit; otherwise the paw will move tenderly, embracing the answer.

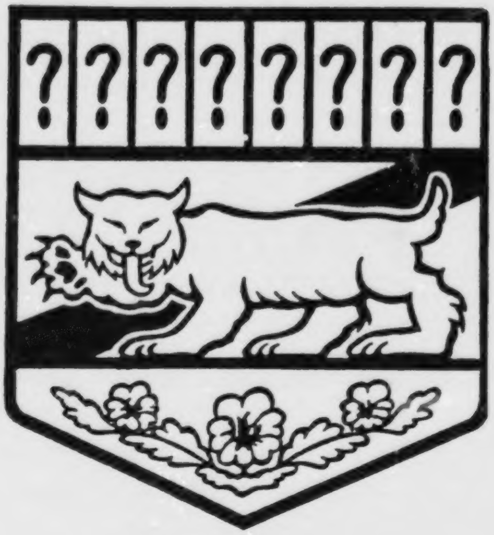


Figure 2
The Shield of Inquiry

The pansies in the lower third stand for thought, that stirring in the brain that raises questions. Only the diagonal remains. What does it mean? Why include it? Therein lies the whole point of the shield!

Historically, schools have had a bias towards the stable mode, and not inappropriately either, because society created the school as a conserving institution charged with the responsibility of passing on the best of the culture and truth, both revealed and acquired. The teacher acts as an information dispenser in the stable mode. The rush of change of the past two decades threatens to overwhelm children and adults trained in handling knowledge in the stable mode only. The flood of new ideas and values forces us to learn the inadequacy of such training for our students. They cannot escape the press of new ideas because of the presence everywhere of media, TV and computers. They need skills of the dynamic mode.

The school strikes a new balance then and teaches to both modes. Hence, we see a greater emphasis today on the teaching of "thinking skills", creativity, and independent research projects. These emphases demand that the student of today, and indeed those of future, need to be able to manage more information, and to integrate and apply it to changing circumstances. The time to be aware of and teach to the dynamic mode is now!

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APPENDIX F
USER'S GUIDE
AND
EXPERIMENTAL EDITIONS
OF
MEASURE OF QUESTIONING SKILLS

USER'S GUIDE BOOK

MEASURE OF QUESTIONING SKILLS

By Ralph Himsl and Garnet Millar

Name ______________________ Age ____ Sex ____

School ______________________ Grade __________

Location ______________ Date ____________________

EXPERIMENTAL EDITION

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Foreword

The art of asking questions is the indispensable element of intelligent behaviour. There is a scarcity of research available on this topic. Torrance (1986) in a personal communication, has indicated that teaching children to ask questions is a fertile area and should be pursued with vigor.

At the very root of any intelligent act is the sense of inquiry. When a person ceases to question, that person ceases to be intelligent. **The Measure of Questioning Skills** and this teacher's guide have been created out of a desire to keep alive an individual's need to question and to help teachers respect the individual's right to ask questions.

Not only does the questioning act set the intellectual process in motion but keeps it going and sustains it. Let us examine Torrance's definition of the creative process and see how dependent the entire process is upon the ability to ask questions. He has defined creativity "as the process of sensing defects, problems gaps in knowledge, and disharmonies; searching for solutions, making guesses and formulating hypotheses about solutions; testing these hypotheses and usually revising and retesting and elaborating them; and finally communicating the results". The ability to question is at the root of the sensing of something missing or wrong. Tension is aroused. A person beset by this urge to question is stimulated to do something to relieve the tension. This starts a search for possible solutions. Thus, the individual is driven to experiment, to check other sources of information, and otherwise search for the truth.

The Model of Cognition developed by the authors explains two aspects of intelligence - the stable component which is essential to consolidate and understand facts and the dynamic mode which helps to create knowledge. This model of cognition is explained below.

One of the most impelling drives in children is curiosity. This drive expresses itself in the disposition to question and to wonder about life and people. The sensitive teacher respects the questions, ideas, and rights of children to initiate their own learning efforts, and their right to reject the adult's ideas in favour of their own after serious consideration.

We hope that the **Measure of Questioning Skills**, and ideas presented in this guide will make it easier to master the skills required to allow children the right to ask questions and express novel ideas. There must be an atmosphere of receptive and active listening, responsiveness, and wonder.

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I. Rationale

Historians identify a number of key inventions in the cultural development of human kind: the wheel, for example, and most people would accept the discovery of fire as another. Movable type, the internal combustion engine and the clock have had far reaching effects. The last fifty years have produced nuclear energy, and the computer, Although, common usage has somewhat debased the word "marvelous," these inventions and discoveries merit that description.

Back of all of them though, lies another marvelous, and at first blush, apparently innocuous invention: the disposition to ask a question. Too bad in a way, that we should have such familiarity with this ability, because we overlook some aspects of questioning, most notably its constantly renewing effects.

A few years ago, Arno Penzias, Nobel Laureate, addressed the Swedish Parliament on the occasion of his award of the prize for physics. In a somewhat surprising address, considering the occasion, Penzias spoke of the importance of asking questions, and gave voice to the chilling thought that in the schools, **we learned as children not to ask questions**.

Certainly, the schools do not want to teach children not to ask questions. Daily observation of teachers reveals concern for the skill. Most instructional sessions end with the remark "Are there any questions?" This may bring little response, and when it does elicit a response, the questions often relate to process rather than substance: "How many pages did you say we had to read? Does this assignment count?" In many classes, students do ask questions, but, in many other classes the children seem to have learned the lesson of which Penzias spoke.

Our biographical literature contains many references to the dispositions of the subject to ask questions, especially so and not surprisingly does this description appear in biographies of scientists. Sometimes, the description takes on a loftier tone, describing the person as having an enquiring mind. This unfortunate abstraction steals from the strength of the better description: "As a child he asked many questions." A person in the school business, prefers that description, because it holds out the possibility of teaching children to ask questions. An "enquiring mind" sounds like a gift: she came into the world with it, along with her dark brown eyes, and we can only admire that; but we can teach persons to ask questions and how to ask them.

The act of asking a question shows a mind not quite at ease. Asking a question itself, creates a tension within the person which persists until relieved by an answer which satisfies. A question asked shows a mind willing to learn.

A question placed in a conversation acts like a still photograph in the sense that it stops the action underway. In fact, the language has conventions which demonstrate this aspect. People use the polite entree, "I don't quite understand; would you please . . .?" A more aggressive conversational expression accomplishes the same thing and more literally too. We say "Hold it right there! What did you mean when you said . . .?" The question permits an exploration of a concept, in the same way that a still photograph encourages the analysis of a scene.

It helps to conceive of questions as fingers of the mind. Just as fingers open the hand to pick up an object, turning it so that the eye may explore its different aspects, even dismantling it, so questions open the mind to explore an idea or concept. Just as a person refines the use of his amazing fingers by practice, so does refinement of questioning come through practice and coaching.

A number of influences combine to dampen the spirit of questioning in school. In our culture as a whole, we have had the disposition to respect authority, and the school enjoys some of that respect. The literal base of society and education lends immense credit to the written word. Schools teach a reverence for books as the vessel of the truth which children learn. The constraints on the classroom can discourage the comparison of the writings of different "authorities" on a topic. Exploration of different authorities would demonstrate that even on "facts" people disagree. The inclination to question demonstrates a healthy, searching skepticism. Teachers protest that the demands of the prescribed courses of study consume the time available for instruction. To a person unfamiliar with school room routines, this matter of constraints to "cover the course" seems somehow inadequate as an explanation for skimping on the teaching of questions. However, a cumbrous structure moderates the teacher's work. Provincial Departments of Education have programs of studies and curriculum guides shot through with words like core subjects, required topics, prescribed texts. Students write achievement tests and diploma exams, competency tests and tests of basic skills. The classroom teacher has evaluators to assess the "quality of the instruction." These factors of themselves, need not discourage the development of a setting in which students learn to ask questions. However, they have not always left the teacher comfortable with taking the time to deal with the spontaneous enquiry of children.

Curriculum developers have tried with varying degrees of success to overcome the tendency to teach content by developing the "enquiry method" of instruction. When used according to design, this method requires the direct teaching and use of questions as the guide to study. Its widespread use would make Penzias' criticism of the schools as archaic as the practice of "birching."

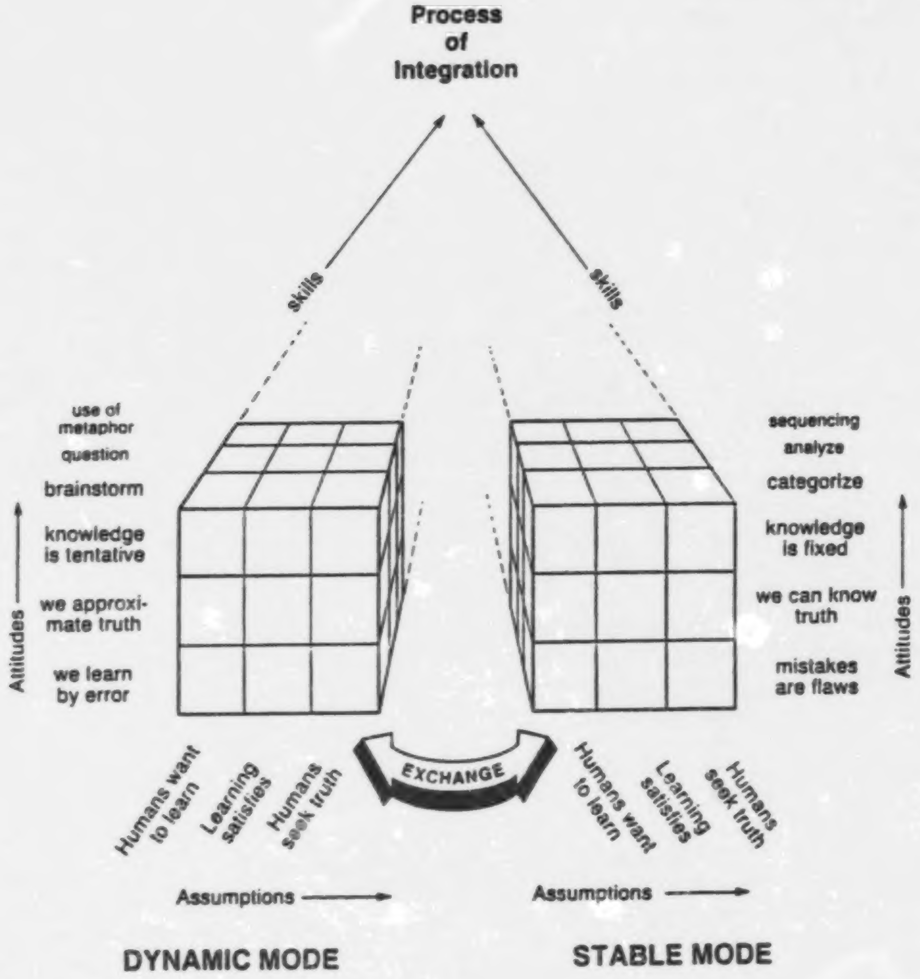
Perhaps, the schools have erred in seeing questioning as an attitude and therefore in some way responsive to admonition and encouragement; and perhaps schools have placed too much emphasis on questioning by the wrong person, namely the teacher. Teachers find a productive course in understanding questioning as a skill or a behaviour, subject to analysis, demonstration, practice and development. In short, they see it as a skill which they can teach, like the skill of writing, a skill which the student needs to learn.

II. A Cognitive Model

A cognitive model developed by the investigators is an attempt to explain intelligent behaviour and the central place of curiosity or questioning. Figure 1 sets out two ways or modes of knowing; a stable mode and a dynamic mode. Each mode has the same three dimensions: assumptions about learning, attitudes towards learning, and skills of learning. These three dimensions provide an operational definition for knowledge in each of the two modes.

Figure 1

A COGNITIVE MODEL



Process of Integration
skills
skills
use of metaphor
question
brainstorm
knowledge is tentative
we approximate truth
we learn by error
Attitudes
sequencing
analyze
categorize
knowledge is fixed
we can know truth
mistakes are flaws
Attitudes
EXCHANGE
Humans want to learn
Learning satisfies
Humans seek truth
Humans want to learn
Learning satisfies
Humans seek truth
Assumptions
Assumptions
DYNAMIC MODE
STABLE MODE

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The two modes have common assumptions about the disposition of people towards learning: they seek truth; they want to learn; and learning satisfies. The attitudes toward error, truth and knowledge and related skills distinguish one mode from the other. The exchange arrow denotes the flow of ideas from one mode to the other. The process of integration combines the distinctive workings of the two modes - Stable and Dynamic.

The Stable Mode

In schools, we direct much of our teaching to the Stable Mode, and much of students' learning is centered in the Stable Mode. In this component of the model, errors count as mistakes. In the Stable Mode, two and two make four. Any other sum means an error. The sun must "rise" each day; any claim to the contrary upsets people and marks the person as unbalanced in some way, prone to error in basic matters. Our psychological well-being requires a knowledge of a large store of what some people call "true facts." These facts accumulate to make what we know as truth. In the stable mode, we have truth and furthermore, we can know truth.

Society has a parallel to this stable mode, as if responding to the need of individuals for stability. Churches, the system of laws, financial institutions, the family unit, schools, governments, customs, language, and police forces all have a stabilizing, or conserving function. Standing on a basis of this sort, a society can handle a strong current of invention and development or dynamism - the products of entrepreneurs, scientists, scholars, theologians, artists, inventors and social reformers. **Clearly, we need to teach for learning in the Stable Mode.**

Skills of the Stable Mode

The stable mode has a set of skills appropriate to the assumptions about and attitudes toward learning: some types of questioning, categorizing, planning, counting, measuring, model making, logical reasoning, deducing, memorizing, accounting, recording, sequencing. All skills of great power. Children need to know them; the school has done much to teach them.

The Dynamic Mode

The attitudes characteristic of the dynamic mode permit a view of knowledge marked by action and movement. In contrast to the view of error as flaws in the stable mode, in the dynamic mode, errors point the seeker to truth. The student looks at the mistake and in a moment of self-communion says, "I missed there, but I'll keep on looking." In the dynamic mode, errors do not reflect on the person who made them; errors inevitably mark the path to discovery. Were one to ascribe a purpose to errors in the dynamic mode, that purpose would be towards direct the person to truth.

In the dynamic mode we do not get to know truth. Perhaps at best, we approximate it. And so we account for the vulnerability of scientific theories to the test of diligent enquiry; those theories, "crouch" in a kind of apprehension lest this new test prove them inadequate, wrong or in error. Each new test takes us nearer the truth, but each step closer, falls short of full realization of truth.

Skills of the Dynamic Mode

Like the stable mode, the dynamic mode has a set of skills appropriate to it; the skills customarily associated with creativity. E. Paul Torrance, distinguished researcher in the area creativity, asserts that "You need courage to be creative. Just as soon as you have a new idea, you are in a minority of one. And being in a minority of one is uncomfortable - it takes courage" (1971).

Figure 1 suggests some skills such as the familiar brainstorming technique, questioning, use of metaphor, incubating, guessing, imagining, hypothesis making, synthesizing, use of paradox, compromising, reversing, tentativeness, tolerance for ambiguity and speculating. These skills can move and create ideas and thought in a constructive manner.

The skill of questioning needs a little more examination. Some kinds of questioning belong in the stable mode. Who, what, where, when, why and how, for example. The "six friends" of Rudyard Kipling belong in the stable mode, because the answers to those questions describe things as they are. Two additions to this set of six questions, whext and whif, move the questioning process into the dynamic mode. "Whext" and "whif" have no acceptance in the English language; suffice it to say that they stand for two powerful additions to the questioning process. "Whext" means **what next** and invites the elegant thinking act of hypothesis formation as a response. "Whif" represents an equally strong idea; it means **what if**. What would happen to a particular system if we altered a certain factor? "Whif" looks like a first step to invention itself.

The "Exchange Arrow" in the Cognitive Model

The productive person integrates the process of knowing in each of the modes. Everybody in good mental health has a set of concepts, behaviours and attitudes which they hold more or less tenaciously. These "certainties" provide a secure base which enables persons to carry out the experiments, speculations and adventures implied in the actions of the dynamic mode. By and by, the actions of the dynamic mode uncover or invent new ideas which the person accepts and assigns them a place in the stable mode. In other words, learning has taken place.

Something like the following seems to take place which is represented by the "exchange arrow" in Figure 1: a signal goes from the stable mode to the dynamic mode that the person has a strong hold on some "certainties" permitting adventures into the unknown, the ridiculous, or the speculative. For its part, the dynamic mode feeds its discoveries through the exchange arrow to the stable mode where these new ideas must pass the test of the deliberate work of the stable mode.

By virtue of the complementary actions of the two modes in the model, and the communication represented by the exchange arrow, the individual moves toward an integration of new knowledge. In brainstorming, for example, the participants working in the Stable Mode, identify a problem, such as, "In what ways can we persuade smokers to stop smoking?" In search of solutions, the participants abandon the patterns of the stable mode, and venture willy-nilly into the almost frivolous. For example, "Smoke gets in your eyes. Smoking lowers your IQ. My mom won't like it. Dirties my teeth." They suspend the critical faculty and produce recklessly. They combine, enlarge, eliminate, minify, elaborate, reverse, etc. to move ideas into new structures. After a period of such free association, the results are sorted and confirmed by the critical faculties of the Stable Mode.

III Purpose and Use

PURPOSE

The **Measure of Questioning Skills** is a "liberating tool" whereby teachers can determine the quantity and quality of students questions, and where students can understand and learn the value of questioning in their school and life experiences.

This **User's Guide** is meant to describe and explain the **Measure of Questioning Skills,** and more importantly, prescribe some teaching strategies that can be used to improve a student's ability to question.

The **Measure of Questioning Skills** is composed of eight pictures depicting various situations that elicit questions. In a specified time period, an individual records as many questions as possible that relate to the ambiguous pictures.

Briefly, the **Measure of Questioning Skills** has two purposes:

1. To measure the quantity and quality of questions produced by examinees.
2. To assist instructors to teach in such a way to improve the quality and quantity of questions.

Appendix A contains suggestions to teach the skills of questioning.

IV. Administration Instructions

1. REQUIREMENTS FOR ADMINISTRATION

a) Stop watch
b) Activity booklets
c) Pencil and eraser
d) Printed instructions

2. WORKING TIME

36 minutes (4 minutes per picture and 4 minutes for review at end of test).

3. INSTRUCTIONS (READ ALOUD THE SECTIONS IN BOLD CAPITAL LETTERS)

Pass out the Measure of Questioning Skills booklet. Keep booklets face up on desk. The picture on the front cover of the booklet will be used to introduce the activity as a "warm-up" exercise.

> **GOOD MORNING/AFTERNOON. TODAY WE ARE GOING TO DO AN ACTIVITY TO FIND OUT HOW MANY QUESTIONS YOU CAN ASK. ONLY FOR PUPILS IN GRADES 3-6. WHO CAN TELL ME WHAT A QUESTION IS? (AN ASKING SENTENCE; A STATEMENT OF OPENNESS.)**
>
> **FOR ALL AGES. THE PURPOSE OF A QUESTION IS TO SEEK INFORMATION ABOUT SOMETHING. CAN SOMEONE GIVE ME A QUESTION ABOUT THE PICTURE OF THE CRYSTAL BALL ON THE COVER OF THE ACTIVITY BOOKLET? DON'T BE AFRAID IF SOMEONE MIGHT THINK THAT THE QUESTION IS SILLY.**

Elicit as many different questions as possible in a 2-3 minute period. Record a few of the questions on the chalkboard during this period of introduction. Make no judgement about the quality of the questions. Emphasize the words that typically begin a question (e.g., who, what, why, when, what if, how, etc.) and end with a question mark (?).

Allow the examinees time to print/write the information required (name, age, sex, school, grade, city and date) on the cover of the activity booklet.

Erase the questions from the chalkboard before the examinees start to print/write questions.

> **THIS BOOKLET CONTAINS PICTURES WHICH INVITE YOU TO ASK QUESTIONS. DON'T TURN THE PAGE UNTIL TOLD TO DO SO. WHEN YOU LOOK AT EACH PICTURE, IMAGINE YOURSELF THERE ON THE SPOT. WHAT ARE YOU WONDERING? PRINT/WRITE AS MANY DIFFERENT QUESTIONS ABOUT THE PICTURE AS YOU CAN. TAKE TIME TO SEARCH OUT THE MEANING OF THE PICTURE FOR YOU. SPELL THE WORDS AS WELL AS YOU CAN.**

> **YOU WILL HAVE 4 MINUTES PER PICTURE TO PRINT/WRITE AS MANY DIFFERENT QUESTIONS AS YOU CAN. DO NOT TURN THE PAGE UNTIL TOLD TO DO SO. AT THE END OF THE ACTIVITY BOOKLET YOU WILL HAVE AN EXTRA 4 MINUTES TO ADD MORE QUESTIONS TO ANY OF THE PICTURES YOU WISH IN THE BOOKLET. READY.**

Read the following instruction printed inside the front cover under the title "Writing Questions from Pictures". (Page 1)

> INSTRUCTIONS
>
> TURN YOUR BOOKLET OVER, TURN TO PAGE 1.
>
> **ON THE EIGHT PAGES TO FOLLOW ARE PICTURES. WRITE AS MANY DIFFERENT QUESTIONS AS YOU CAN ABOUT EACH PICTURE. TRY TO THINK OF QUESTIONS THAT NO ONE ELSE WILL THINK OF. DON'T BE AFRAID IF NO ONE ELSE WOULD AS THE QUESTION. YOU NEED NOT WORRY ABOUT KNOWING THE ANSWER! YOU MAY WISH TO SUPPOSE THAT SOMEONE WHO YOU REALLY LIKE KNEW ALL ABOUT THE PICTURES. WHAT QUESTIONS WOULD YOU ASK TO FIND OUT ABOUT THEM? TAKE TIME TO STUDY THE PICTURE CAREFULLY.**
>
> BEGIN

Allow exactly 4 minutes per picture

> **AFTER 3 MINUTES, TELL THE EXAMINEES, "YOU HAVE ONE MINUTE LEFT".**

Each time the page is turned to a new picture, display the test booklet opened at the appropriate picture.

> **SAY, "YOU SHOULD BE ON THIS PICTURE. STUDY THE PICTURE CAREFULLY FOR 10 SECONDS BEFORE PRINTING/WRITING".**

Provide a short break after the fourth picture. At the end of the eighth picture, give the examinees exactly 4 minutes to add more questions to any of the eight pictures.

> **SAY, "MAYBE YOU CAN THINK OF QUESTIONS YOU WANT TO ASK ABOUT SOME OTHER PICTURE NOW. LOOK BACK AT THE OTHER PICTURES AND ADD ANY MORE THAT YOU CAN THINK OF. GO AHEAD NOW."**

Collect the booklets.

V. A Classification of the Management of Information Using Questions

Introduction

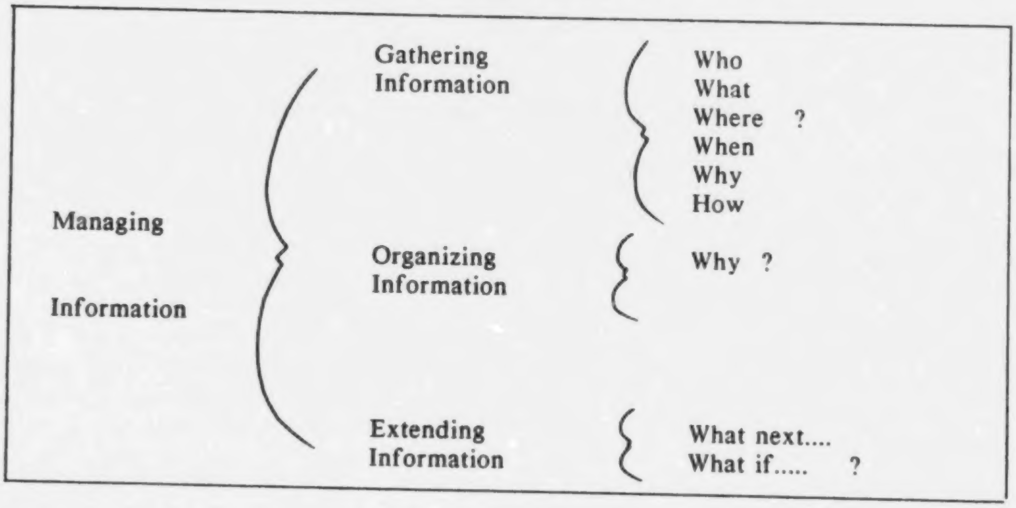
One of the challenges facing the learner today is how to manage information in a constructive and purposive way.

The investigators have devised three stages of conceptualizing the management information, namely; **gathering information**, **organizing information** and **extending information**. Each stage is important in understanding, clarifying and creating information. Certain types of questions can be used to manage information at each stage. See Figure 2 for a schema of the three stages of the management of information with corresponding questions.

Figure 2

Stages in the Management of Information

With Attendant Questions


Managing
Information
Gathering
Information
Who
What
Where ?
When
Why
How
Organizing
Information
Why ?
Extending
Information
What next....
What if..... ?

VI. Descriptions and Examples of Questions Related to the Stages of the Management of Information

STAGE 1: GATHERING INFORMATION

Descriptions and Examples

Basal Questions are concerned with basic **facts.** This type of question occurs at all grade levels and is especially common to Grade 3. Basal questions can be **answered** - perhaps not solely by the information given in the picture, but ultimately there is an answer for this type of question. These questions begin with "who, what, where, when, why and how many/much." ("How come" questions do **not** belong in this category).

EXAMPLES
1. Is the boy lost?
2. How old is the boy?
3. Is that an Indian?
4. How long will it take him to get to Niagara Falls?
5. Why isn't his Mum with him?

A **procedural question** seeks information about how something happened. These questions want to know how the event took place or how a specific task was performed. These questions usually begin with "how".

EXAMPLES
1. How did the man get in the barrel?
2. How did the accident happen?
3. How did the skeleton get in the eye?
4. How does the spaceship fly on two boosters?

STAGE 2: ORGANIZING INFORMATION

Descriptions and Examples

Purposive Questions are broken down in to the categories objective and assumptive. **Purposive objective:** This type of question wants to know the reason or the underlying cause of an action. It is a higher-level question; it accepts what is given in the picture, but still wants to know why the picture is the way it is. Questions that begin with "how come" are purposive questions.

EXAMPLES
1. Why are they leaving Earth?
2. How come he's in the tub?
3. What is the horse on the track for?
4. Why does that man have a magnifying glass?

Purposive assumptive: These questions challenge the initial view about the picture.

EXAMPLE
1. Why isn't he in a boat?
2. Why isn't there anyone around?

These examples are assumption questions because they challenge what is occurring - why wouldn't the man be in a boat instead of a barrel (as boats are a more common means of transportation), and if there was an accident, why wouldn't there be any people around, either those in the accident itself or at the scene to watch?

STAGE 3: EXTENDING INFORMATION

Description and Examples

This type of question accepts the situation given in the picture, but wants to know what happens next. **It projects beyond the apparent.**

EXAMPLE
1. Is the train going to hit the horse?
2. Will the driver of the car go to jail?
3. Will the horse die?
4. Is the plant going to fall on his head?

A **speculative question** takes the situation in the picture and "moves" the situation farther than what the picture suggests. This type of question takes the information from the picture, takes an intellectual risk and expands on the information which ultimately creates "new knowledge" about the situation. Often speculative questions begin with "What if" but they can also start with "Is she/he..." or "Are they ..." and "I wonder".

EXAMPLES

1. What if the train doesn't stop?
2. What if the man in the barrel goes over the falls?
3. I wonder if the horse sees the train?
4. I wonder if she's a murderer?
5. Will they run out of oxygen? - in this context the child is saying "what if" they don't have enough air and so it is a speculative question.
6. Is the horse suicidal? Again the child is asking "what if" the horse is trying to kill himself and so it is a speculative question.

VII Scoring the Measure of Questioning Skills

In scoring the **Measure of Questioning Skills**, each question must be read carefully and categorized into one of the five types of questions. Example of question types are found. A tally sheet is provided on page 19 to record data. The tally sheet indicates both a frequency score and qualitative index.

The raw scores can be charted to provide a graph illustrating frequency and types of questions. This graph is found on page 20. Normative Tables for Grades 3 to 10 inclusive are found in Appendix B. The tables are organized by type of question, picture (8), gender and grade.

VIII. TALLY SHEET FOR MEASURE OF QUESTIONING SKILLS: RAW SCORES

NAME: ____________________ AGE: ____________________

SCHOOL: ____________________ DATE: ____________________

Managing Information → / Picture Number ↓	Gathering Information		Organizing Information		Extending Information		
	Who What Where When Why How much/many	How	Why (objectives)	Why (Assumption)	What Next? "whext"	What if? "whif"	Sub Totals (frequency
1 Boy-Station							
2 Man-Barrel							
3 Car-Bicycle							
4 Horse-Train							
5 Man-Magnifying Glass							
6 Man-Woman							
7 spaceplane							
8 Eye							
Subtotals (frequency)							Total (frequency)

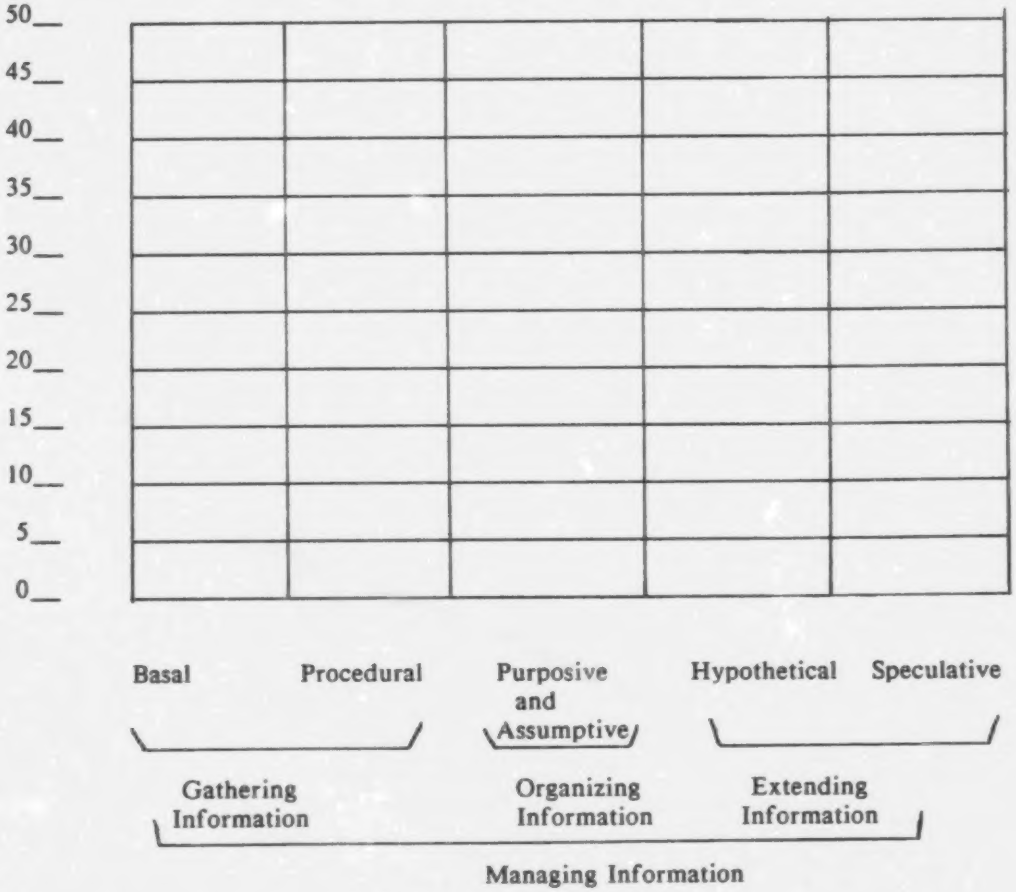
IX. INDIVIDUAL RECORD

CHARTING RAW SCORES FOR MEASURE OF QUESTIONING SKILLS

NAME:____________________ DATE:__________________

LOCATION:__________________

____



X. Selected Bibliography

This current bibliography is provided for those who may be interested in further reading on the topic of questioning.

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Appendix A

Suggestions to Assist Instructors in Teaching the Skills of Questioning

Implications for Teaching

Rewarding students for asking questions. Teaching children to ask questions requires a slight change in emphasis. Historically, schools have taught the primary importance of the correct answer and developed ways of conveying this emphasis: nods of approval, check marks, expressions of commendation, stars, and, more recently happy faces. Interestingly enough, schools also conveyed the message that there is a correct answer, a view held by much of our culture. Events of the last fifty years or so, have tended to bruise this confidence, and we have come to see our knowledge and our answers as tentative; their rightness subject always to modification by the receipt of new information. This permits us to admit the luxury of a change: we still want the "right" answer, or at least the best one we can get. But now the questions as the means of acquiring more information and alternative answers, assumes a new significance.

The skill of asking questions and the disposition to do so require the same kind of affirmation that the correct answer earns: nods of approval, supportive repetition and smiles. Furthermore, the teacher can use remarks like: "I've never heard that one before! Good Question. Do you all understand what she asked! Can anyone in the room answer that question? I'll make a note of that one and we'll come back to it. That opens up a whole new field." And then in their report to the parents, the teachers note that the students ask many good questions.

Jennie P and her Wonderful Wonder Book

One teacher, Jennie Pawlak of Lethbridge, Alberta has learned much about the nature of questioning by having her children maintain a "Wonder Book". She has a regular writing assignment for her boys and girls that requires them to produce two questions each day. They do this in their best handwriting and date the entry. After a year of this work, the children have accumulated an array of enquiry, some of it stunning in the thought represented. The imagination soars at the effect of an accumulation of such Wonder Books developed each school year and kept for the whole of a child's school life. It would make an interesting intellectual autobiography.

Twenty Questions

Sometimes a teacher needs to reassure a class of the acceptability of asking questions. A few short sessions using the old parlour game "Twenty Questions" helps free children of their inhibitions. The rules of this game permit the identification of the "hidden" subject as animal, vegetable or mineral in origin. The challengers may ask any question that an answer "yes", "no" or "partly" will satisfy.

Designing Lessons Using Student Questions

A teacher can build an outline to a lesson or unit of study based on student questions by using a simple technique. After an introduction designed to stimulate questions, the teacher invites the class to brainstorm questions they wish to have answered during the unit of study. The teacher records all of these on the chalkboard - - - David and McKenzie (1985) suggest a good entree: "What questions should be asked about . . .?" and then with the participation of the class ranks them and chooses which questions the study will seek to answer.

As a variation of this technique, the teacher assigns a topic for a creative writing exercise. He leads the class in brainstorming questions about the topic and, as before, records all of the questions produced. On completion of the assignment, the students identify the questions they wish to answer, arrange them in a satisfying sequence and respond to them, using the customary conventions of good language usage to ensure a smooth flow of text.

The Four C's of Good Questioning

Students might learn the "ethics" of good questioning - the four Cs. Courteous, Cogent, Concise, Clear. At times though, especially during a divergent exercise, the class ought not to concern itself much with these four Cs, since much attention given to them could inhibit the flow of possibly useful questions.

Iwwn . . Questions

David and McKenzie (1985) identify the value of developing a typology of questions: Fact Questions, Why Questions, Imagine Questions. Creative problem-solving techniques include a searching formula. "In what ways might we change the room? Change our minds? Express our sadness? Feel better? Accept the gloom?"

The teacher can use the typology to help students develop lists of questions. "Try some imagine questions." Use a hypothetical "what if" question. "Now let's try some fact questions."

Whext/Whif Questions

Students ought to know Rudyard Kipling's doggerel:

"I have six friends
They taught me all I know:
Who, What, Where, When, Why and How."

Kipling had good friends there, indeed; but we can now add a couple more. Good qualities notwithstanding, his six friends are limited in that the answers they provide yield a description of things as they are; essentially a stable description. A teacher could add two more questions, one of which gives a dynamic quality to the resulting description, **whext** (meaning "what next?"); and second, **whif** invites the enquirers to use the intellectual skills of hypothesis formation, and whif disposes them to the creative activity of imagining.

And so, the teacher can improve the effect of Kipling's doggerel if not its aesthetics

I have **eight** friends
They taught me all I know:
Who, What, **Whext**, Where, **Whif**, When,
Why and How.

The teacher helps students use these questions as a first scan in the examination of any topic.

Active Reading

Students can apply the skill of questioning during their written assignments. The teacher instructs the students to make a two-inch margin on the right side of their note page. In this margin they record questions which occur to them as they work on the assignment. This act has a kinship to that of "active reading". In active reading, the reader records reactions and questions with respect to the text in the margin of the book under study. As a last step in review of the assignment, the teacher checks to see if the student's study has addressed, but not necessarily answered, all of the questions.

Evaluating the Ability to Ask Questions

Teachers can build into their evaluation procedures assessment of the disposition of students to ask questions. The test paper includes items which invite the students to ask questions: such as a reproduction of a newspaper photograph either on the test paper itself, or in the form of an overhead transparency. Editorial cartoons lend themselves to this type of challenge. Teacher can use reproductions of works of art to stimulate questions. Short textual selections, particularly of well known passages such as anthems and the Lord's Prayer, can provide interesting challenges to students when used as stimuli to questions. Think of the second verse to "God Save the Queen", as an example.

O Lord our God arise,
Scatter her enemies,
And make them fall,
Confound their politics,
Frustrate their knavish tricks
On Thee our hopes we fix,
God save us all.

The teacher analyzes the responses on the basis of the number and quality of the questions, and awards an appropriate mark.

APPENDIX B

TENTATIVE NORMS BY TYPE OF QUESTION, PICTURE, GENDER, AND GRADE LEVEL

Table 1

Mean Number of "Gathering Information" Questions for Picture 1 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	6.79	6.21	7.76	14.42	10.62	14.71	9.18	8.71
	- SD	2.20	2.03	2.96	5.82	4.31	5.96	1.95	4.32
Female	- N	14	19	10	5	9	7	22	86
	- M	6.46	5.58	8.60	12.50	12.22	18.50	9.04	9.11
	- SD	2.74	2.64	2.80	1.00	2.26	3.64	3.81	4.63
Total	- N	52	40	29	11	26	19	33	210
	- M	6.70	5.91	8.05	13.54	11.17	16.10	9.09	8.88
	- SD	2.33	2.33	2.88	4.28	3.76	5.45	3.27	4.44

Table 2

Mean Number of "Gathering Information" Questions for Picture 2 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	6.05	5.67	7.97	12.42	9.44	14.58	8.50	8.10
	- SD	2.34	1.55	2.26	3.64	6.36	6.00	2.42	4.46
Female	- N	14	19	10	5	9	7	22	86
	- M	7.25	5.97	9.90	15.80	11.78	19.00	7.20	9.19
	- SD	2.24	2.78	3.27	2.34	3.68	4.20	2.41	4.79
Total	- N	52	40	29	11	26	19	33	210
	- M	6.38	5.81	8.64	13.96	10.25	16.21	7.64	8.54
	- SD	2.36	2.20	2.76	3.45	5.61	5.71	2.45	4.62

Table 3

Mean Number of "Gathering Information" Questions for Picture 3 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	7.46	6.50	9.24	12.83	13.91	15.17	12.59	9.92
	- SD	2.95	1.53	3.28	3.66	5.48	5.69	5.12	4.89
Female	- N	14	19	10	5	9	7	22	86
	- M	7.18	6.97	10.95	14.40	13.39	18.71	11.16	10.60
	- SD	2.27	3.10	3.24	2.41	2.67	2.93	3.27	4.49
Total	- N	52	40	29	11	26	19	33	210
	- M	7.38	6.72	9.83	13.54	13.73	16.47	11.64	10.20
	- SD	2.76	2.39	3.32	3.11	4.64	5.07	3.96	4.73

Table 4

Mean Number of "Gathering Information" Questions for Picture 4 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	5.68	4.12	8.82	13.75	8.94	14.21	9.68	7.92
	- SD	3.36	2.61	3.36	6.62	4.92	4.92	5.24	5.06
Female	- N	14	19	10	5	9	7	22	86
	- M	5.36	5.60	10.30	16.90	11.22	18.29	7.20	8.80
	- SD	2.48	2.91	3.08	1.34	4.12	4.33	3.48	5.18
Total	- N	52	40	29	11	26	19	33	210
	- M	5.60	4.82	9.33	15.18	9.73	15.71	8.03	8.28
	- SD	3.12	2.82	3.29	5.03	4.71	5.02	4.23	5.11

Table 5

Mean Number of "Gathering Information" Questions for Picture 5 by Sex and Grade

Sex		Grade 3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	7.75	6.36	10.29	15.67	12.12	14.38	14.04	10.08
	- SD	5.01	2.76	4.02	6.03	5.80	5.35	6.84	5.72
Female	- N	14	19	10	5	9	7	22	86
	- M	8.14	7.10	12.15	15.90	14.06	20.50	10.27	11.00
	- SD	3.45	3.00	4.75	2.66	3.87	4.14	3.97	5.28
Total	- N	52	40	29	11	26	19	33	210
	- M	7.86	6.71	10.93	15.77	12.79	16.63	11.53	10.46
	- SD	4.61	2.87	4.29	4.58	5.22	5.69	5.31	5.55

Table 6

Mean Number of "Gathering Information" Questions for Picture 6 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	7.51	5.71	12.00	15.50	12.88	15.38	13.82	10.34
	- SD	5.64	2.19	5.35	5.21	5.97	5.79	6.77	6.27
Female	- N	14	19	10	5	9	7	22	86
	- M	7.50	7.13	11.95	22.40	14.39	18.57	11.02	11.33
	- SD	3.06	2.93	3.90	3.80	4.20	6.25	4.30	5.78
Total	- N	52	40	29	11	26	19	33	210
	- M	7.51	6.39	11.98	18.64	13.40	16.55	11.96	10.74
	- SD	5.05	2.64	4.83	5.68	5.38	6.00	5.31	6.08

Table 7

Mean Number of "Gathering Information" Questions for Picture 7 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	6.93	5.71	10.82	12.67	11.94	13.38	15.00	9.62
	- SD	3.52	2.00	3.69	1.97	5.32	4.68	6.07	5.04
Female	- N	14	19	10	5	9	7	22	86
	- M	6.21	6.60	12.00	16.70	12.67	19.36	10.70	10.48
	- SD	2.46	2.86	4.28	3.99	2.96	3.58	3.34	5.07
Total	- N	52	40	29	11	26	19	33	210
	- M	6.74	6.14	11.22	14.50	12.19	15.58	12.14	9.97
	- SD	3.26	2.45	3.87	3.57	4.58	5.14	4.80	5.06

Table 8

Mean Number of "Gathering Information" Questions for Picture 8 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	6.90	4.79	9.63	11.75	10.62	11.08	11.46	8.51
	- SD	3.71	1.80	4.82	3.00	6.57	5.73	2.66	4.84
Female	- N	14	19	10	5	9	7	22	86
	- M	6.14	6.84	10.85	15.50	9.94	15.93	8.32	9.14
	- SD	2.09	3.36	5.14	3.54	2.87	4.69	2.97	4.51
Total	- N	52	40	29	11	26	19	33	210
	- M	6.69	5.76	10.05	13.46	10.38	12.87	9.36	8.77
	- SD	3.35	2.82	4.87	3.65	5.51	5.76	3.20	4.71

Table 9

Mean Number of "Gathering Information" Questions for All Pictures by Sex and Grade

Sex		Grade 3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	55.08	45.07	76.53	109.00	90.47	112.88	94.27	73.20
	- SD	23.07	11.86	23.03	25.25	36.99	40.65	32.82	35.14
Female	- N	14	19	10	5	9	7	22	86
	- M	54.25	51.82	86.70	130.10	99.67	148.86	74.93	79.64
	- SD	14.66	19.77	28.76	13.14	19.14	26.92	21.40	35.88
Total	- N	52	40	29	11	26	19	33	210
	- M	54.86	48.28	80.03	118.59	93.65	126.13	81.38	75.84
	- SD	21.00	16.25	25.12	22.57	31.83	39.62	26.88	35.51

Table 10

Mean Number of "Organizing Information" Questions for Picture 1 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.03	.10	.03	.33	.06	.12	.09	.07
	- SD	.11	.44	.12	.82	.24	.31	.30	.30
Female	- N	14	19	10	5	9	7	22	86
	- M	.04	.05	.05	.00	.56	.07	.32	.17
	- SD	.13	.23	.16	.00	1.33	.19	.61	.56
Total	- N	52	40	29	11	26	19	33	210
	- M	.03	.08	.03	.18	.23	.10	.24	.11
	- SD	.12	.35	.13	.60	.82	.27	.53	.43

Table 11

Mean Number of "Organizing Information" Questions for Picture 2 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.18	.14	.13	.25	.29	.54	.14	.22
	- SD	.44	.32	.23	.61	.50	.62	.23	.43
Female	- N	14	19	10	5	9	7	22	86
	- M	.18	.03	.20	.00	1.28	.14	.48	.33
	- SD	.37	.12	.48	.00	1.15	.24	.57	.63
Total	- N	52	40	29	11	26	19	33	210
	- M	.18	.09	.16	.14	.64	.40	.36	.26
	- SD	.42	.25	.33	.45	.90	.54	.50	.52

Table 12

Mean Number of "Organizing Information" Questions for Picture 3 by Sex and Grade

		- Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.00	.05	.03	.08	.15	.21	.18	.07
	- SD	.00	.22	.12	.20	.34	.58	.40	.28
Female	- N	14	19	10	5	9	7	22	86
	- M	.14	.05	.20	.00	.28	.00	.27	.16
	- SD	.54	.23	.63	.00	.67	.00	.61	.49
Total	- N	52	40	29	11	26	19	33	210
	- M	.04	.05	.09	.04	.19	.13	.24	.11
	- SD	.28	.22	.38	.15	.47	.47	.55	.38

Table 13

Mean Number of "Organizing Information" Questions for Picture 4 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	1.21	1.05	.76	.83	.85	1.08	1.59	1.07
	- SD	1.39	1.52	.71	.75	1.12	.82	1.46	1.23
Female	- N	14	19	10	5	9	7	22	86
	- M	1.54	.95	.75	.30	3.28	2.00	2.34	1.67
	- SD	1.62	.90	1.09	.27	2.58	2.00	1.27	1.65
Total	- N	52	40	29	11	26	19	33	210
	- M	1.30	1.00	.76	.59	1.69	1.42	2.09	1.31
	- SD	1.45	1.25	.84	.62	2.07	1.40	1.36	1.44

Table 14

Mean Number of "Organizing Information" Questions for Picture 5 by Sex and Grade

Sex		Grade 3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.08	.00	.03	.17	.18	.46	.23	.12
	- SD	.22	.00	.12	.41	.53	1.12	.41	.45
Female	- N	14	19	10	5	9	7	22	86
	- M	.18	.13	.05	.00	1.83	.00	.41	.36
	- SD	.54	.47	.16	.00	1.87	.00	.72	.91
Total	- N	52	40	29	11	26	19	33	210
	- M	.11	.06	.03	.09	.75	.29	.35	.22
	- SD	.33	.32	.13	.30	1.40	.90	.63	.68

Table 15

Mean Number of "Organizing Information" Questions for Picture 6 by Sex and Grade

Sex		Grade 3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.03	.07	.00	.50	.12	.08	.32	.10
	- SD	.11	.24	.00	1.22	.33	.29	.56	.37
Female	- N	14	19	10	5	9	7	22	86
	- M	.04	.00	.20	.10	.50	.00	.14	.12
	- SD	.13	.00	.48	.22	.71	.00	.54	.41
Total	- N	52	40	29	11	26	19	33	210
	- M	.03	.04	.07	.32	.25	.05	.20	.11
	- SD	.12	.18	.29	.90	.52	.23	.54	.39

Table 16

Mean Number of "Organizing Information" Questions for Picture 7 by Sex and Grade

Sex		Grade 3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.10	.07	.21	.33	.65	.54	.36	.27
	- SD	.44	.24	.42	.82	1.07	.89	.67	.65
Female	- N	14	19	10	5	9	7	22	86
	- M	.21	.05	.55	.00	.94	.57	.86	.48
	- SD	.43	.23	1.07	.00	1.76	.89	1.24	1.01
Total	- N	52	40	29	11	26	19	33	210
	- M	.14	.06	.33	.18	.75	.55	.70	.35
	- SD	.43	.23	.71	.60	1.32	.86	1.10	.82

Table 17

Mean Number of "Organizing Information" Questions for Picture 8 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.03	.02	.13	.25	.09	.25	.32	.11
	- SD	.16	.11	.47	.61	.26	.50	.46	.34
Female	- N	14	19	10	5	9	7	22	86
	- M	.14	.00	.25	.00	1.06	.00	.18	.21
	- SD	.54	.00	.79	.00	1.51	.00	.33	.67
Total	- N	52	40	29	11	26	19	33	210
	- M	.06	.01	.17	.14	.42	.16	.23	.15
	- SD	.31	.08	.59	.45	1.00	.41	.38	.50

Table 18

Mean Number of "Organizing Information" Questions for All Pictures by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	1.66	1.50	1.32	2.75	2.38	3.29	3.23	2.03
	- SD	1.80	1.96	1.49	5.29	2.82	4.18	2.33	2.57
Female	- N	14	19	10	5	9	7	22	86
	- M	2.46	1.26	2.25	.40	9.72	2.79	5.00	3.49
	- SD	3.15	1.66	4.43	.42	9.09	2.74	3.45	4.71
Total	- N	52	40	29	11	26	19	33	210
	- M	1.88	1.39	1.64	1.68	4.92	3.10	4.41	2.63
	- SD	2.24	1.81	2.82	3.94	6.65	3.64	3.20	3.66

Table 19

Mean Number of "Extending Information" Questions for Picture 1 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.24	.38	.71	.00	.56	.42	.68	.42
	- SD	.42	.50	.80	.00	.75	.60	.90	.63
Female	- N	14	19	10	5	9	7	22	86
	- M	.39	.26	.45	.00	.44	.00	.57	.37
	- SD	.45	.51	.50	.00	.77	.00	.52	.52
Total	- N	52	40	29	11	26	19	33	210
	- M	.28	.32	.62	.00	.52	.26	.61	.40
	- SD	.42	.50	.72	.00	.74	.51	.66	.59

Table 20

Mean Number of "Extending Information" Questions for Picture 2 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.62	.60	1.16	.00	.68	.62	.91	.70
	- SD	.62	.66	1.36	.00	.58	.83	.83	.83
Female	- N	14	19	10	5	9	7	22	86
	- M	.71	.42	1.05	.10	.67	.57	.80	.66
	- SD	.73	.51	1.14	.22	.61	.93	.50	.70
Total	- N	52	40	29	11	26	19	33	210
	- M	.64	.51	1.12	.04	.67	.60	.83	.68
	- SD	.64	.59	1.27	.15	.58	.84	.62	.78

Table 21

Mean Number of "Extending Information" Questions for Picture 3 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.18	.29	.84	.00	.18	.58	.96	.40
	- SD	.38	.56	1.19	.00	.35	.70	.61	.70
Female	- N	14	19	10	5	9	7	22	86
	- M	.18	.08	.15	.00	.17	.29	.68	.28
	- SD	.37	.25	.34	.00	.35	.49	.63	.48
Total	- N	52	40	29	11	26	19	33	210
	- M	.18	.19	.60	.00	.17	.47	.77	.35
	- SD	.37	.45	1.03	.00	.34	.63	.63	.62

Table 22

Mean Number of "Extending Information" Questions for Picture 4 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.42	.69	.84	.08	.50	.62	1.18	.61
	- SD	.64	.60	1.07	.20	.47	.57	1.17	.76
Female	- N	14	19	10	5	9	7	22	86
	- M	.46	.34	.55	.10	.28	.57	.64	.46
	- SD	.63	.50	.50	.22	.26	.54	.41	.49
Total	- N	52	40	29	11	26	19	33	210
	- M	.43	.52	.74	.09	.42	.60	.82	.55
	- SD	.63	.58	.91	.20	.42	.54	.78	.67

Table 23

Mean Number of "Extending Information" Questions for Picture 5
by Sex and Grade

Sex		Grade							
		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.43	.31	.68	.25	.56	.92	.73	.53
	- SD	.68	.40	1.07	.61	.75	1.08	.34	.76
Female	- N	14	19	10	5	9	7	22	86
	- M	.68	.45	.55	.00	.72	.36	.50	.51
	- SD	.61	.50	.98	.00	.51	.56	.49	.59
Total	- N	52	40	29	11	26	19	33	210
	- M	.50	.38	.64	.14	.62	.71	.58	.52
	- SD	.66	.45	1.03	.45	.67	.95	.45	.69

Table 24

Mean Number of "Extending Information" Questions for Picture 6 by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.34	.45	.92	.00	.65	.67	.86	.55
	- SD	.74	.61	1.28	.00	.74	.62	.50	.81
Female	- N	14	19	10	5	9	7	22	86
	- M	.46	.55	.40	.00	.94	1.00	1.18	.73
	- SD	.66	.86	.39	.00	.73	.87	.70	.77
Total	- N	52	40	29	11	26	19	33	210
	- M	.38	.50	.74	.00	.75	.79	1.08	.62
	- SD	.71	.73	1.08	.00	.74	.71	.65	.80

Table 25

Mean Number of "Extending Information" Questions for Picture 7 by Sex and Grade

Sex		Grade 3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.22	.14	.53	.08	.15	.71	.46	.31
	- SD	.40	.28	.77	.20	.29	.58	.35	.49
Female	- N	14	19	10	5	9	7	22	86
	- M	.21	.08	.25	.00	.06	.14	.16	.14
	- SD	.26	.19	.42	.00	.17	.24	.24	.25
Total	- N	52	40	29	11	26	19	33	210
	- M	.22	.11	.43	.04	.12	.50	.26	.24
	- SD	.36	.24	.68	.15	.26	.55	.31	.42

Table 26

Mean Number of "Extending Information" Questions for Picture 8 by Sex and Grade

Sex		Grade							
		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	.30	.31	.87	.00	.29	1.04	.46	.46
	- SD	.38	.34	1.02	.00	.53	.69	.69	.65
Female	- N	14	19	10	5	9	7	22	86
	- M	.54	.45	.80	.00	.22	1.07	.46	.51
	- SD	.60	.44	.68	.00	.26	1.17	.41	.59
Total	- N	52	40	29	11	26	19	33	210
	- M	.36	.38	.84	.00	.27	1.05	.46	.48
	- SD	.46	.39	.91	.00	.45	.86	.51	.62

Table 27

Mean Number of "Extending Information" Questions for all Pictures by Sex and Grade

		Grade							
Sex		3	4	5	6	7	9	10	Total
Male	- N	38	21	19	6	17	12	11	124
	- M	2.76	3.17	6.55	.42	3.56	5.58	6.23	3.99
	- SD	2.72	2.60	7.20	1.02	2.84	3.85	3.06	4.13
Female	- N	14	19	10	5	9	7	22	86
	- M	3.64	2.63	4.20	.20	3.50	4.00	4.98	3.64
	- SD	2.91	2.71	3.87	.27	2.42	2.20	2.10	2.80
Total	- N	52	40	29	11	26	19	33	210
	- M	3.00	2.91	5.74	.32	3.54	5.00	5.39	3.84
	- SD	2.77	2.63	6.28	.75	2.66	3.36	2.48	3.64

F-61

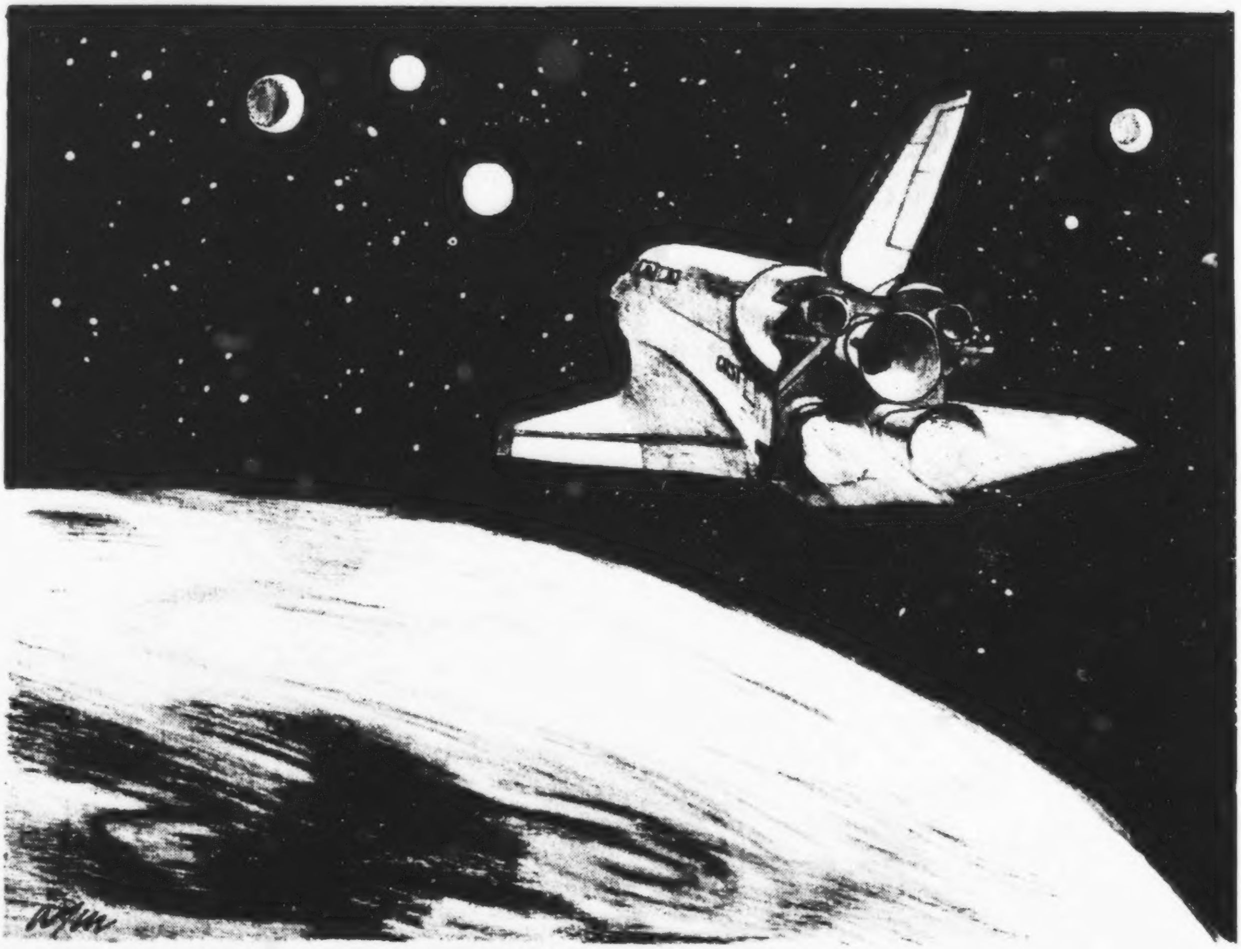
MEASURE OF QUESTIONING SKILLS

By Ralph Himsl and Garnet Millar

Name ______________________ Age _____ Sex _____

School ______________________ Grade __________

City __________________ Date ____________________



EXPERIMENTAL EDITION I

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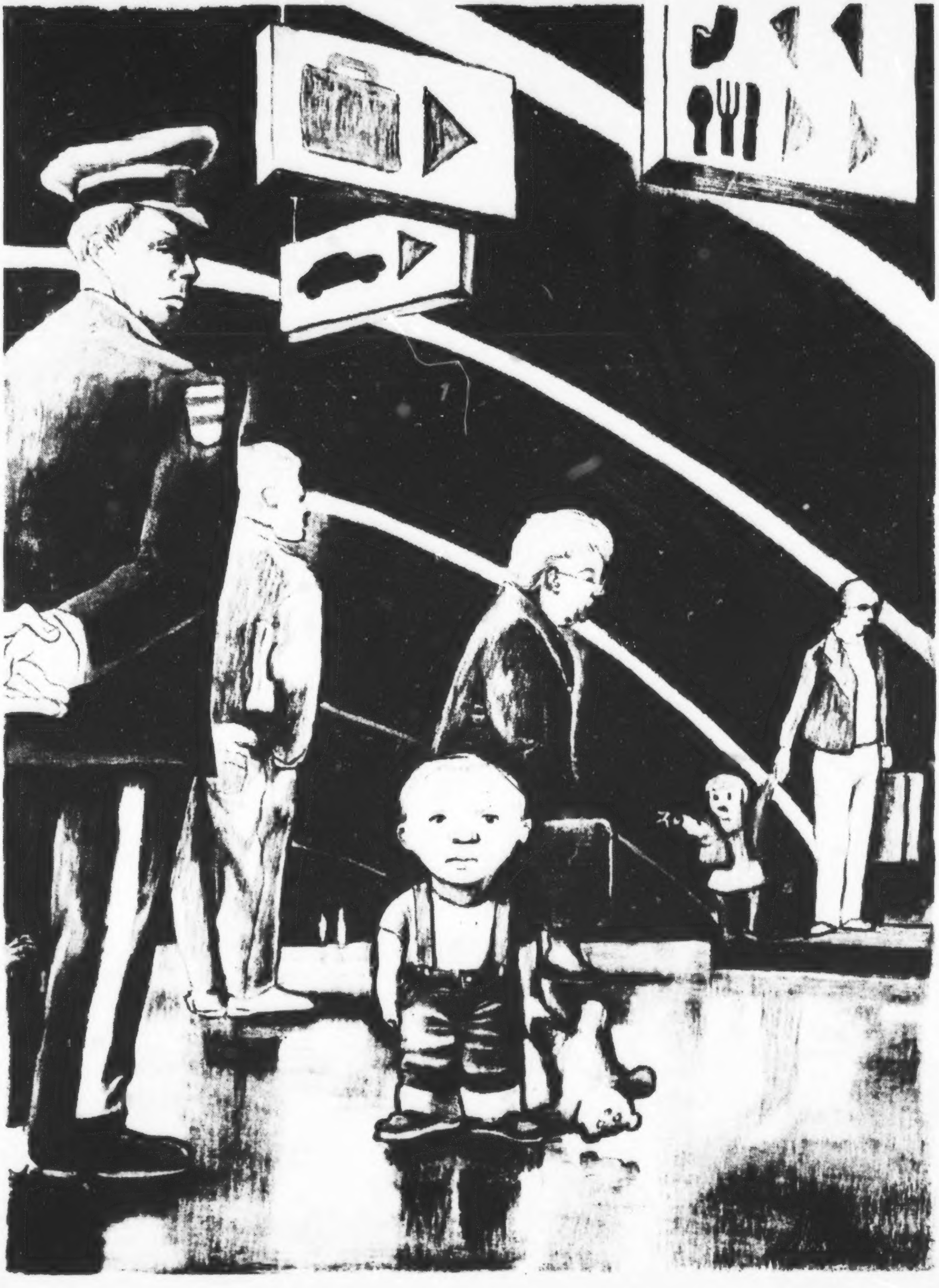
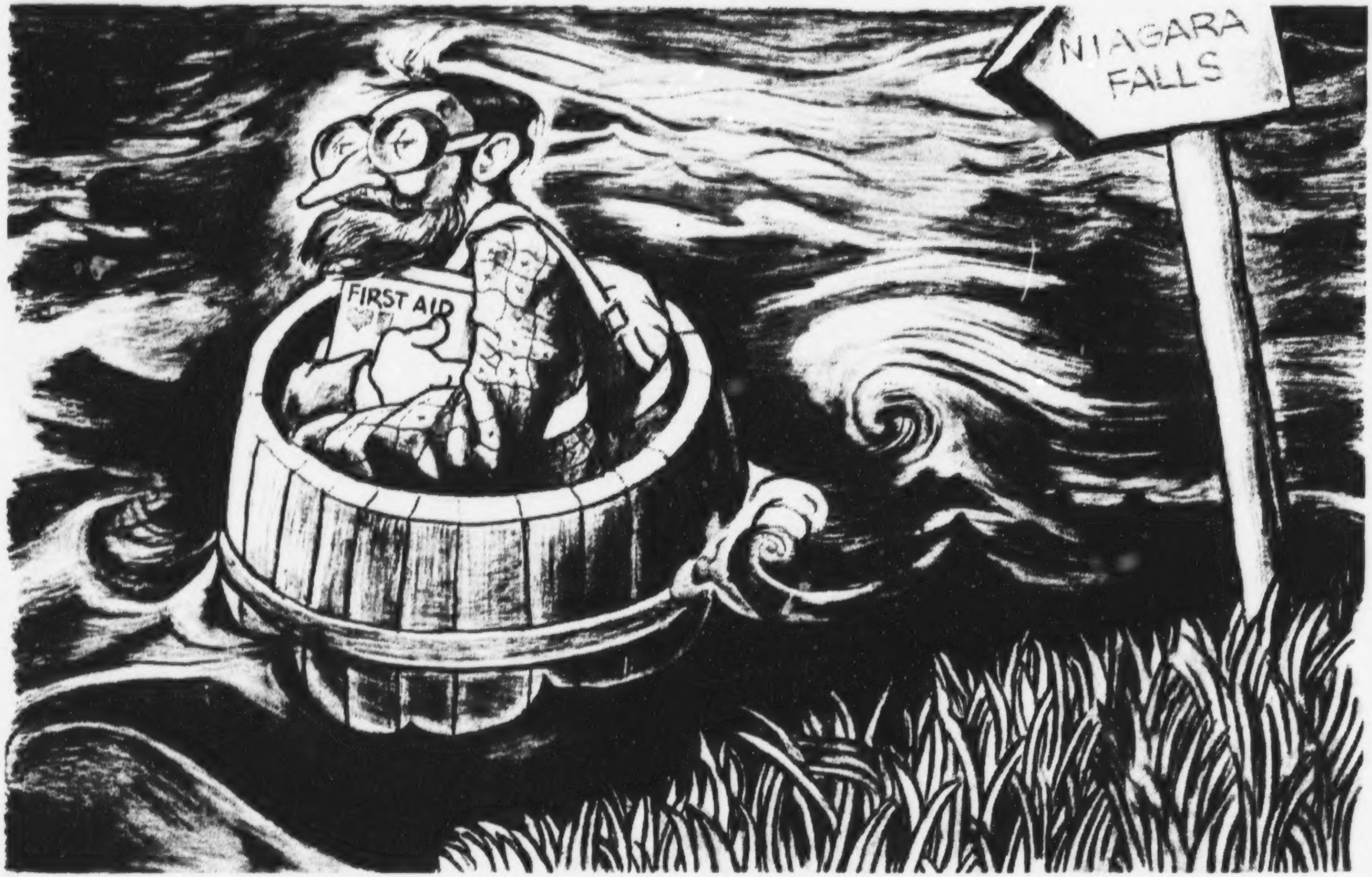
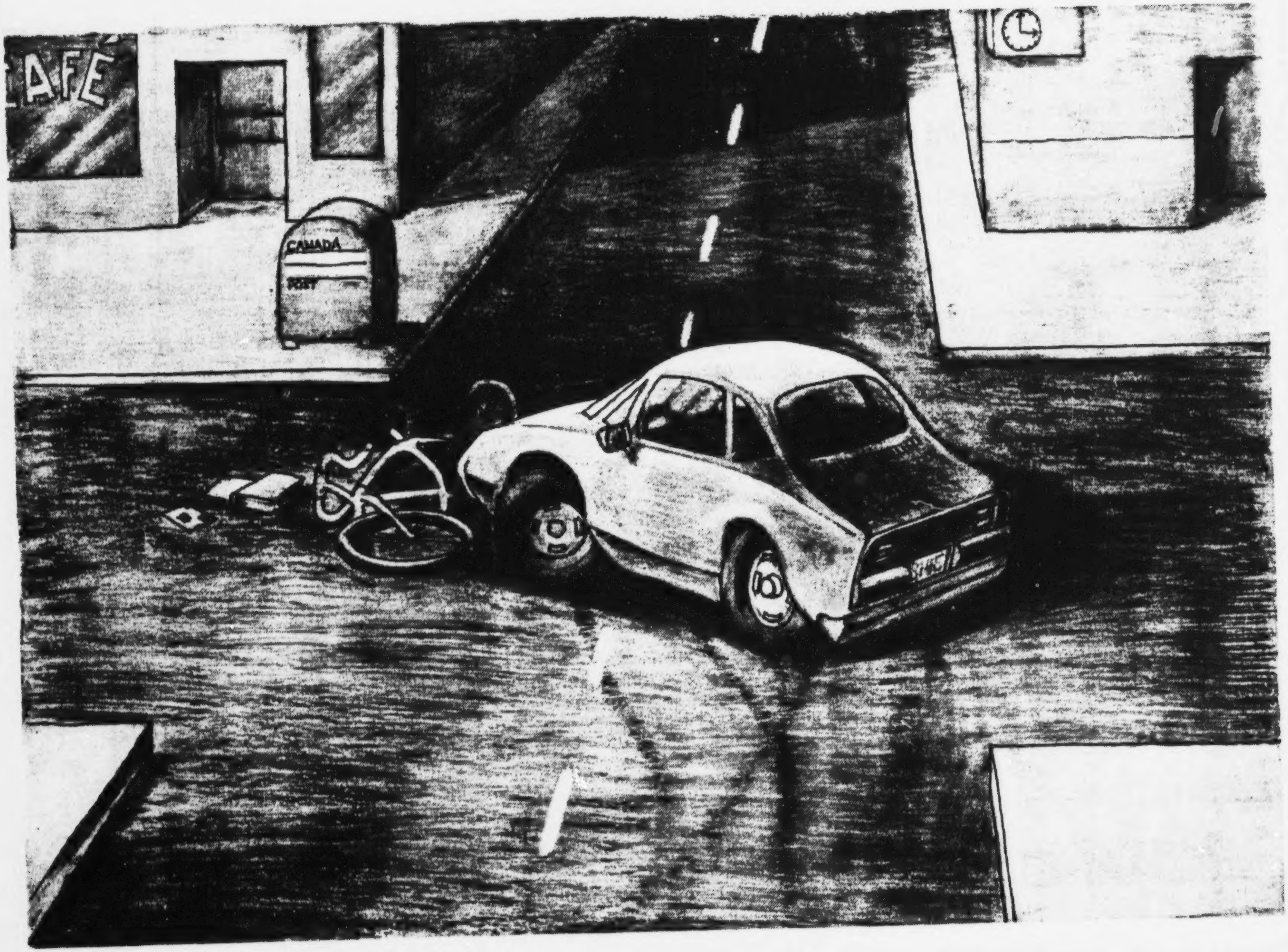
WRITING QUESTIONS FROM PICTURES

Instructions

On the eight pages to follow are pictures. Write as many different questions as you can about each picture. Try to think of questions that no one else will think of. Don't be afraid if no one else would ask the question. You need not worry about knowing the answer! You may wish to suppose that someone whom you really like knew all about the pictures. What questions would you ask to find out about them.




NIAGARA FALLS
FIRST AID


AFÉ
CANADA
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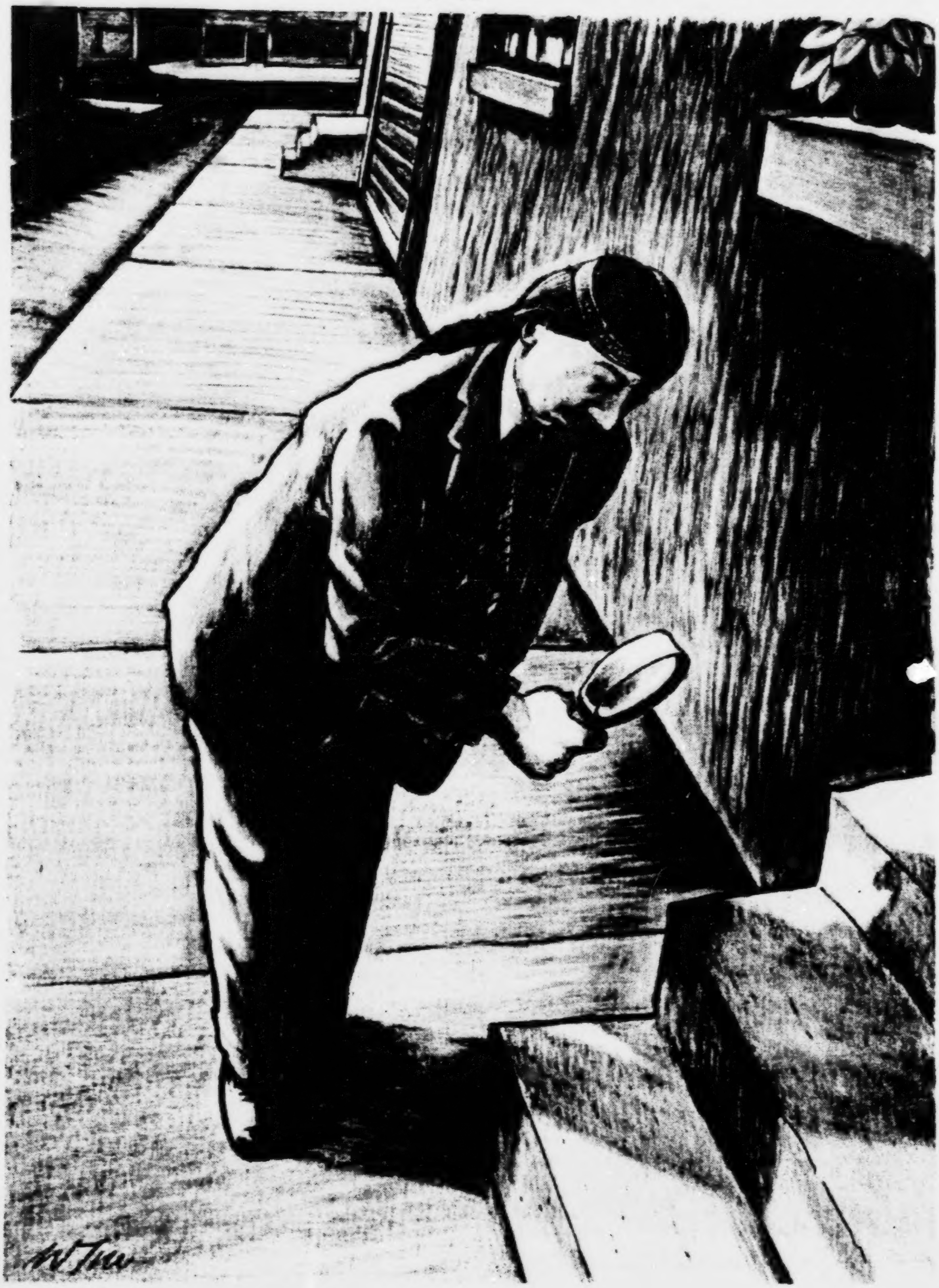

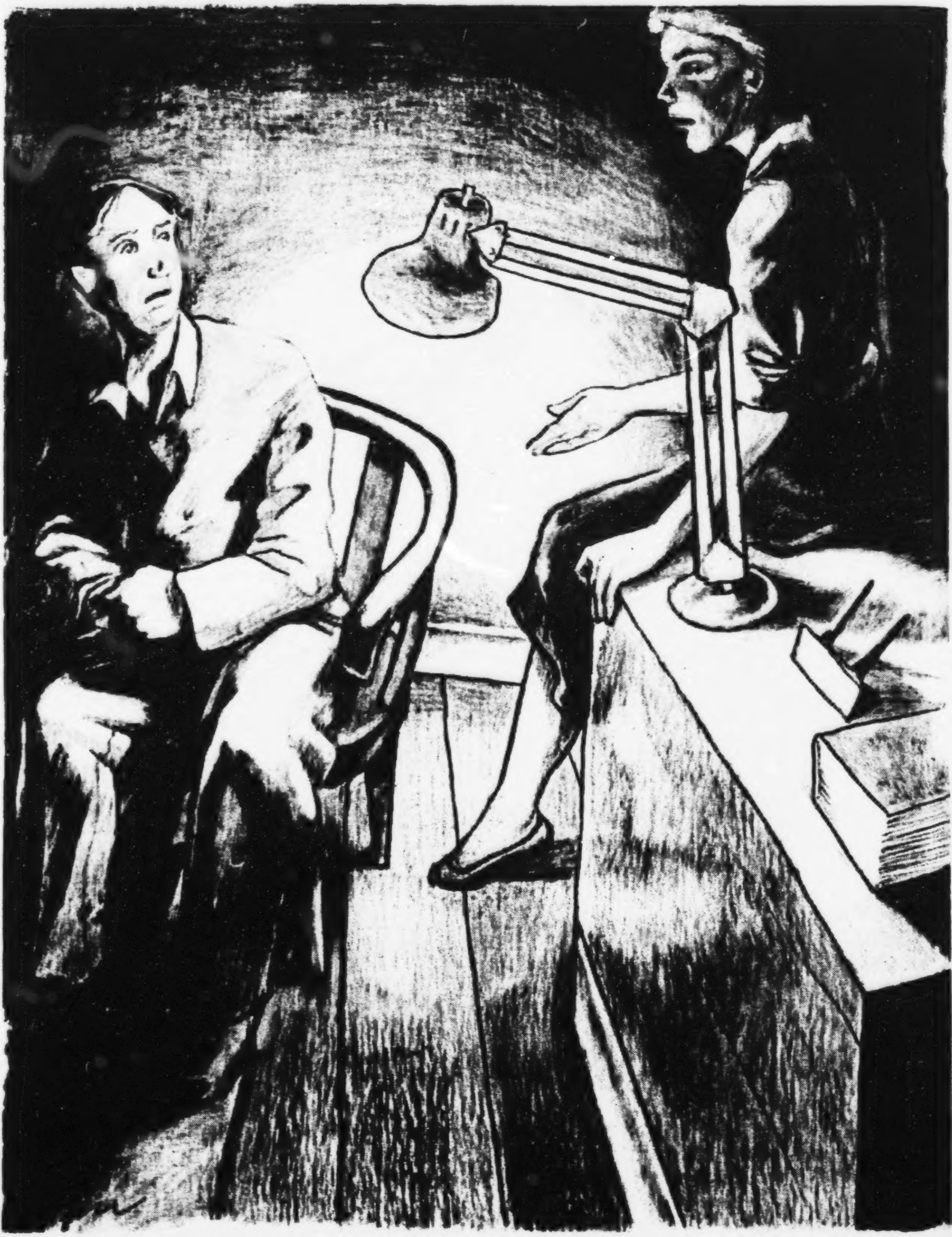

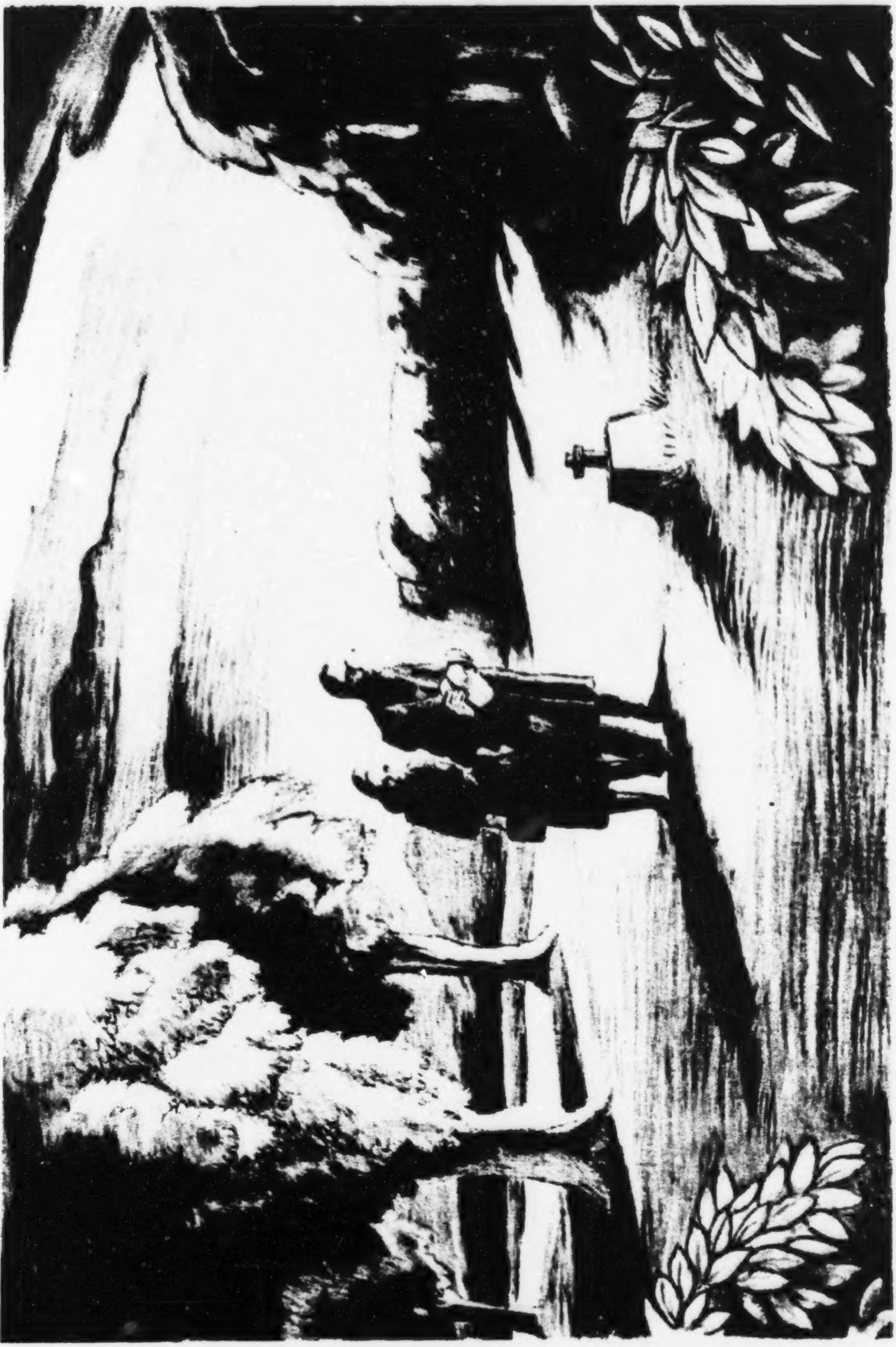

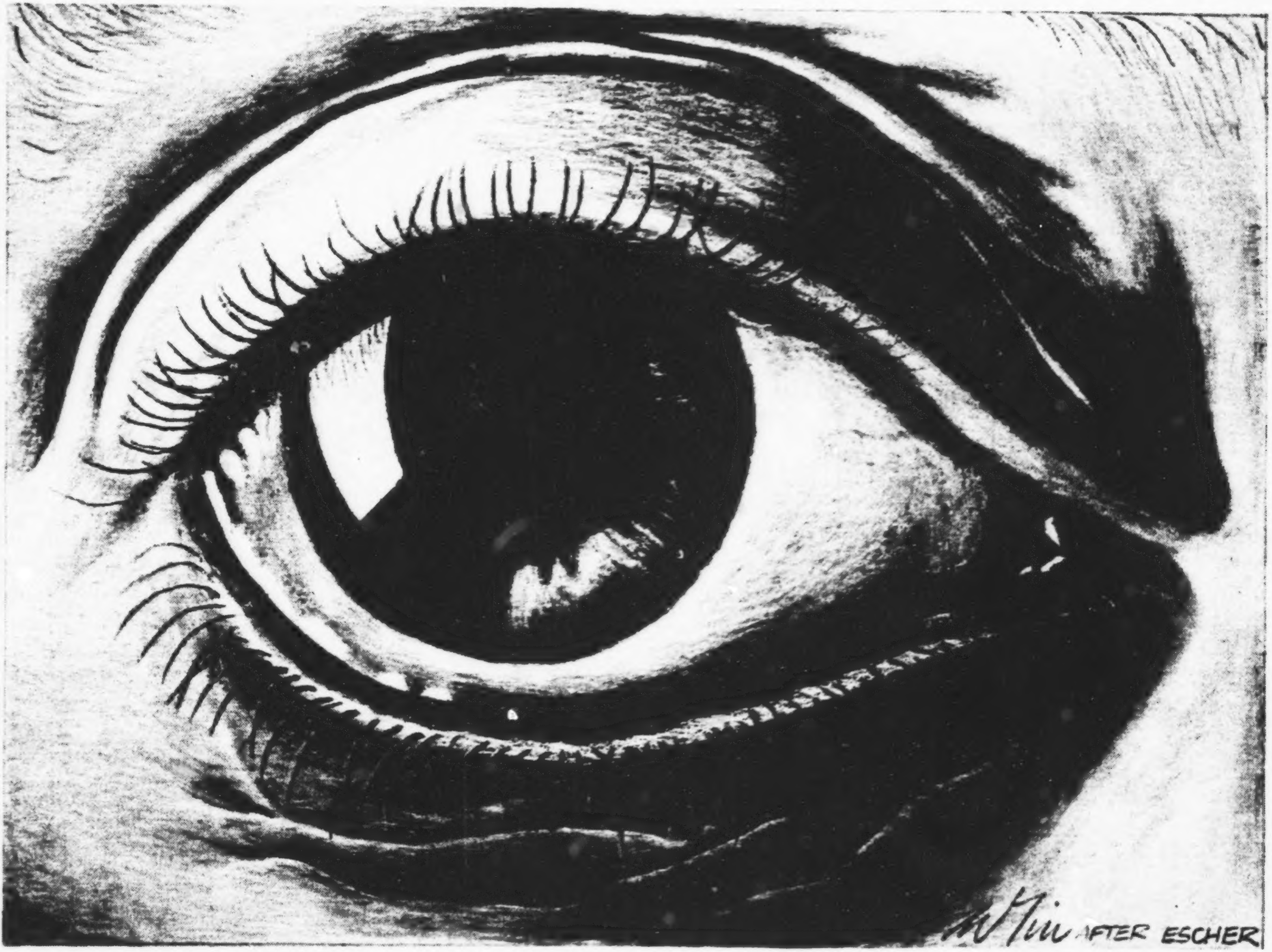

AFTER ESCHER

F-81

MEASURE OF QUESTIONING SKILLS

By Ralph Himsl and Garnet Millar

Name ______________________________ Age _____ Sex ____

School ____________________________ Grade ____________

Location________________ Date _________________________

EXPERIMENTAL EDITION II

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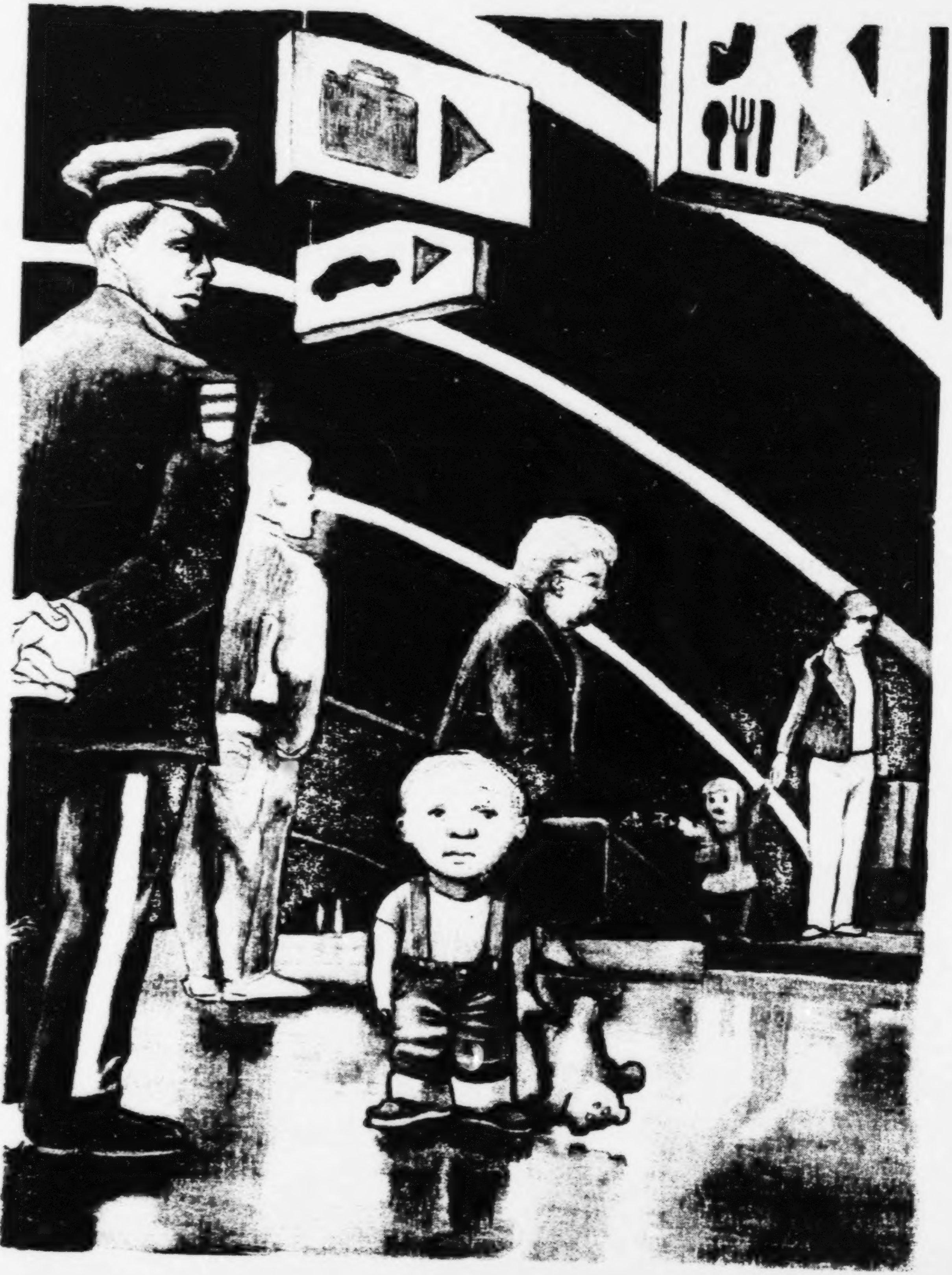
WRITING QUESTIONS FROM PICTURES

Instructions

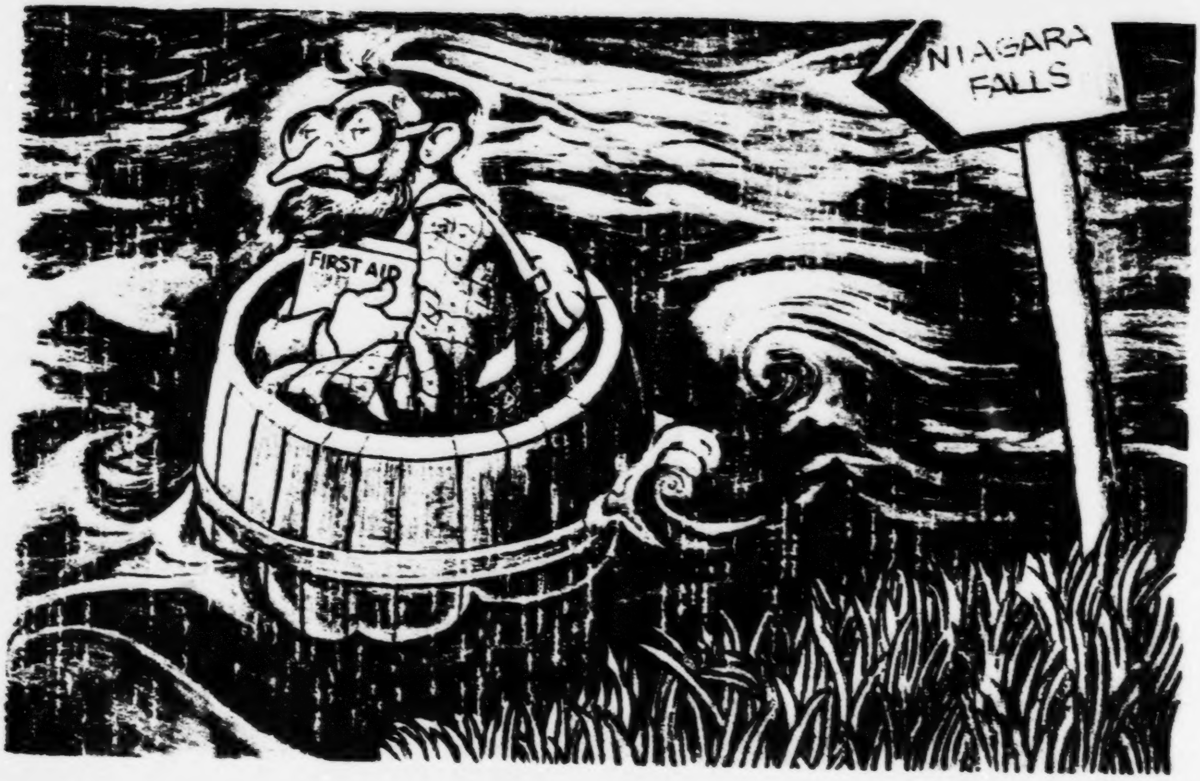
On the pages to follow are eight pictures. Write as many different questions as you can about each picture. Try to think of questions that no one else will think of. Don't be afraid if no one else would ask the question. You need not worry about knowing the answer! You may wish to suppose that someone whom you really like knew all about the pictures. What questions would you ask to find out about them? Take time to study each picture carefully.

F-84

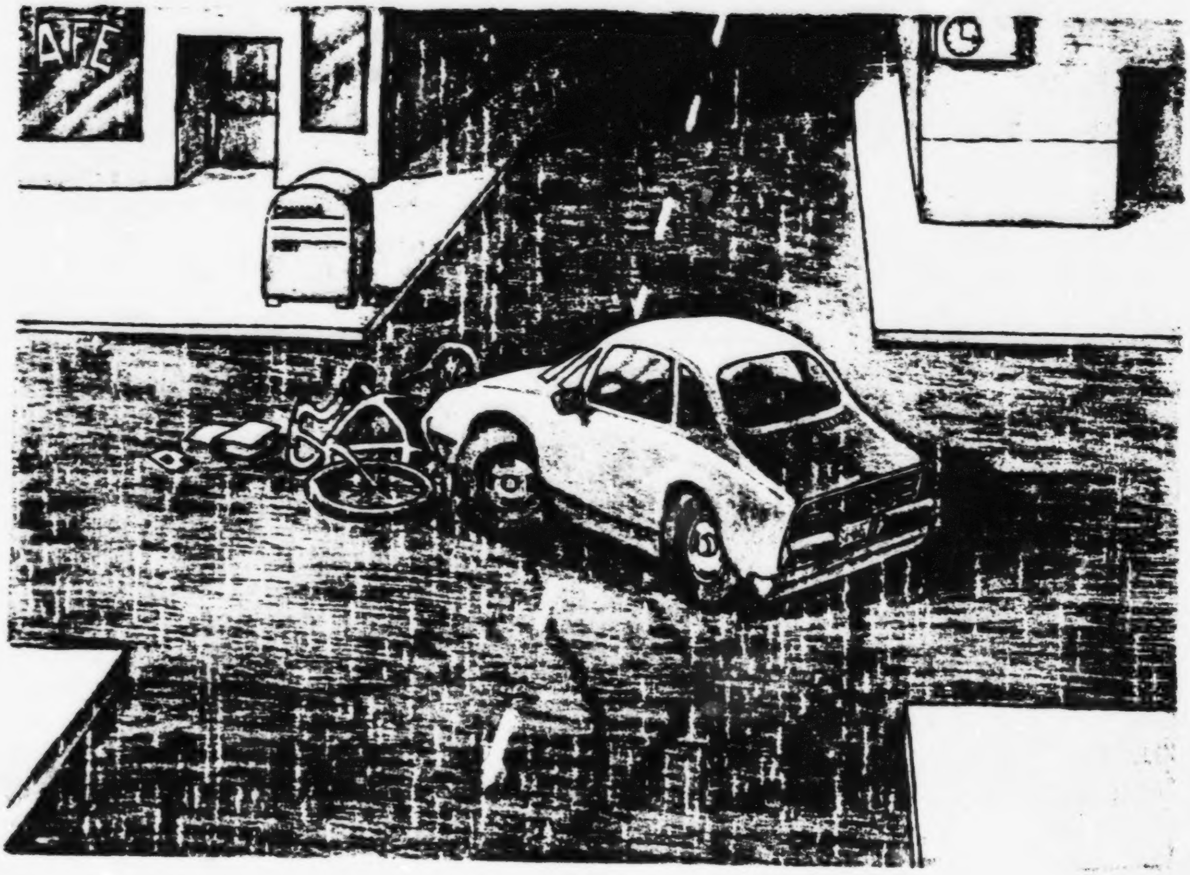
Picture Number One



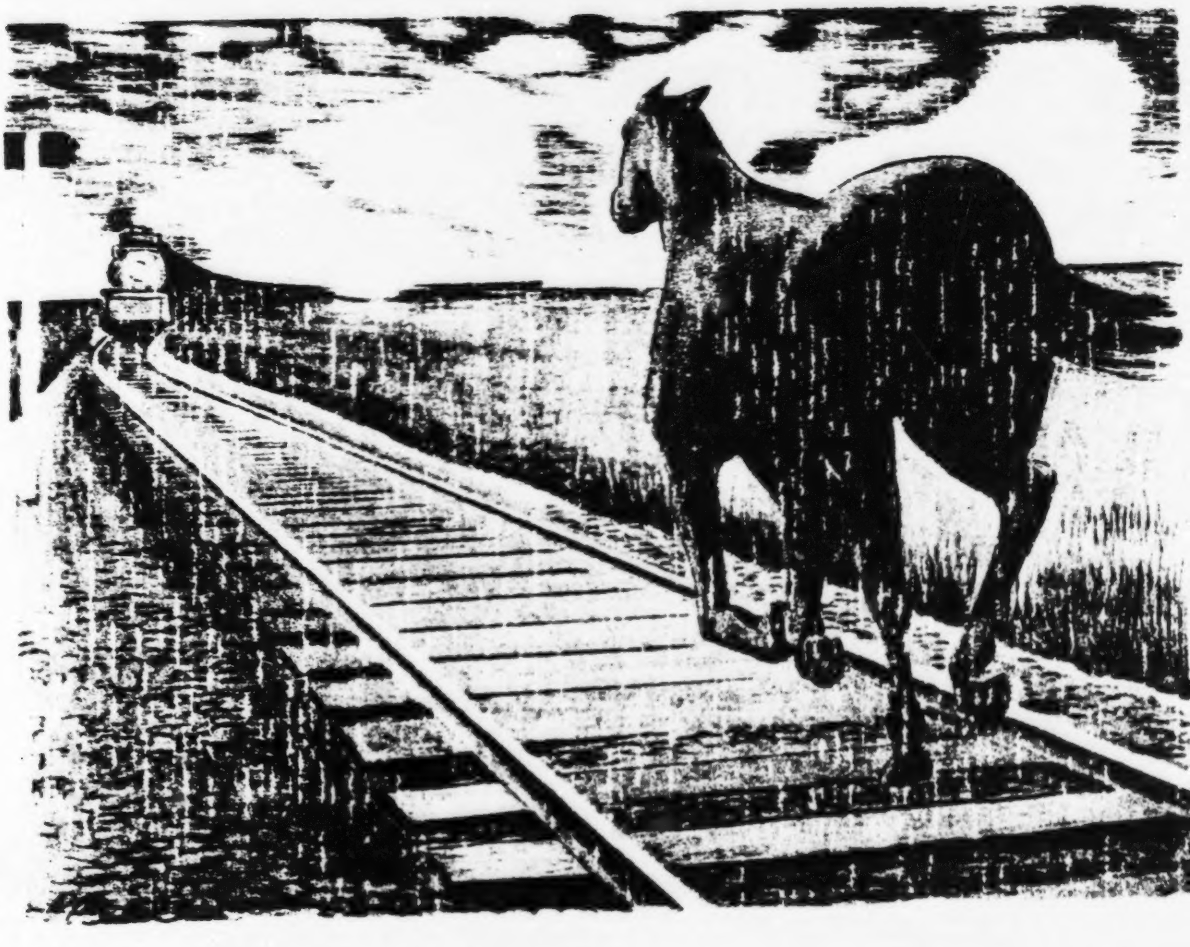
F-86
Picture Number Two


FIRST AID
NIAGARA FALLS

Picture Number Three

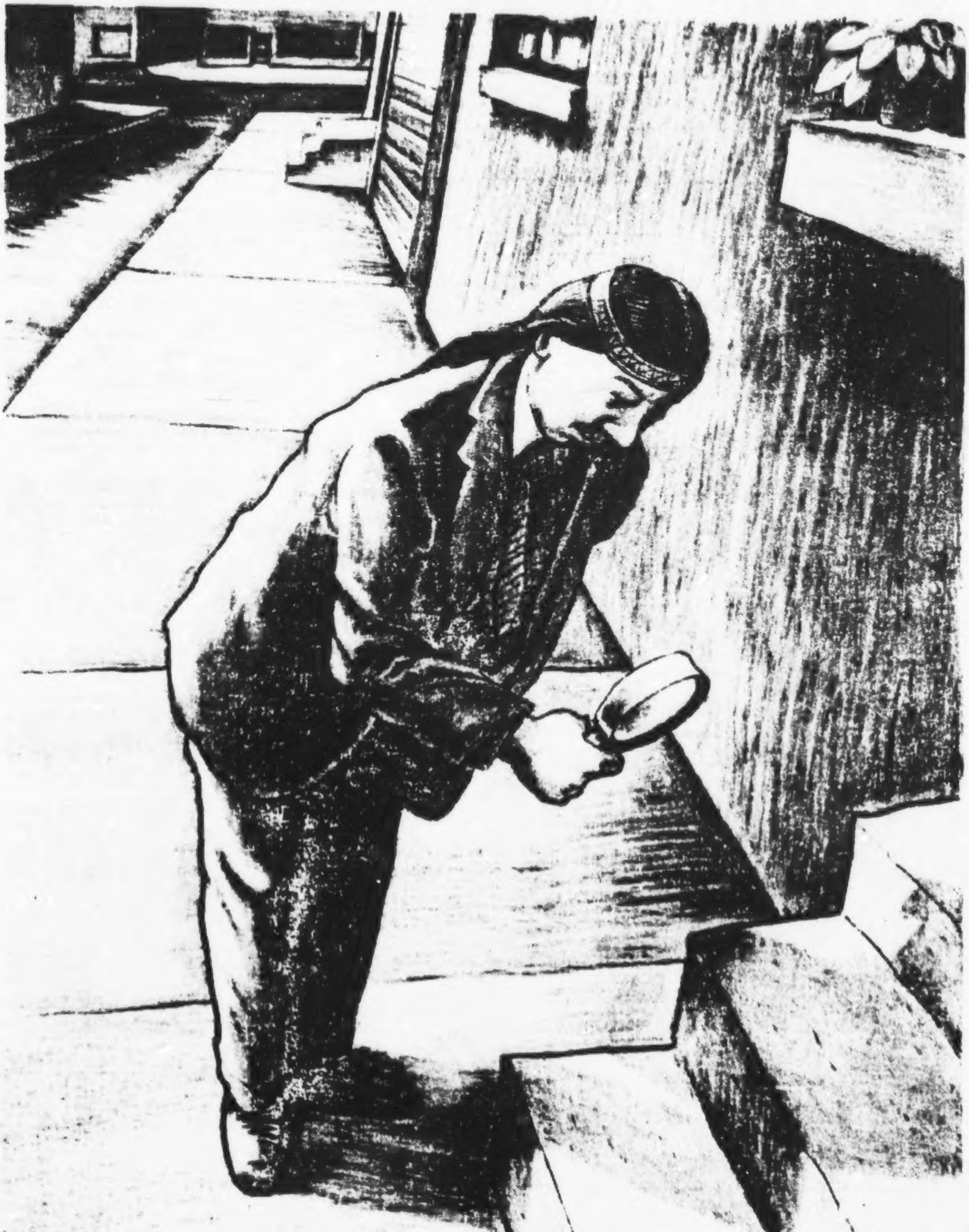


Picture Number Four



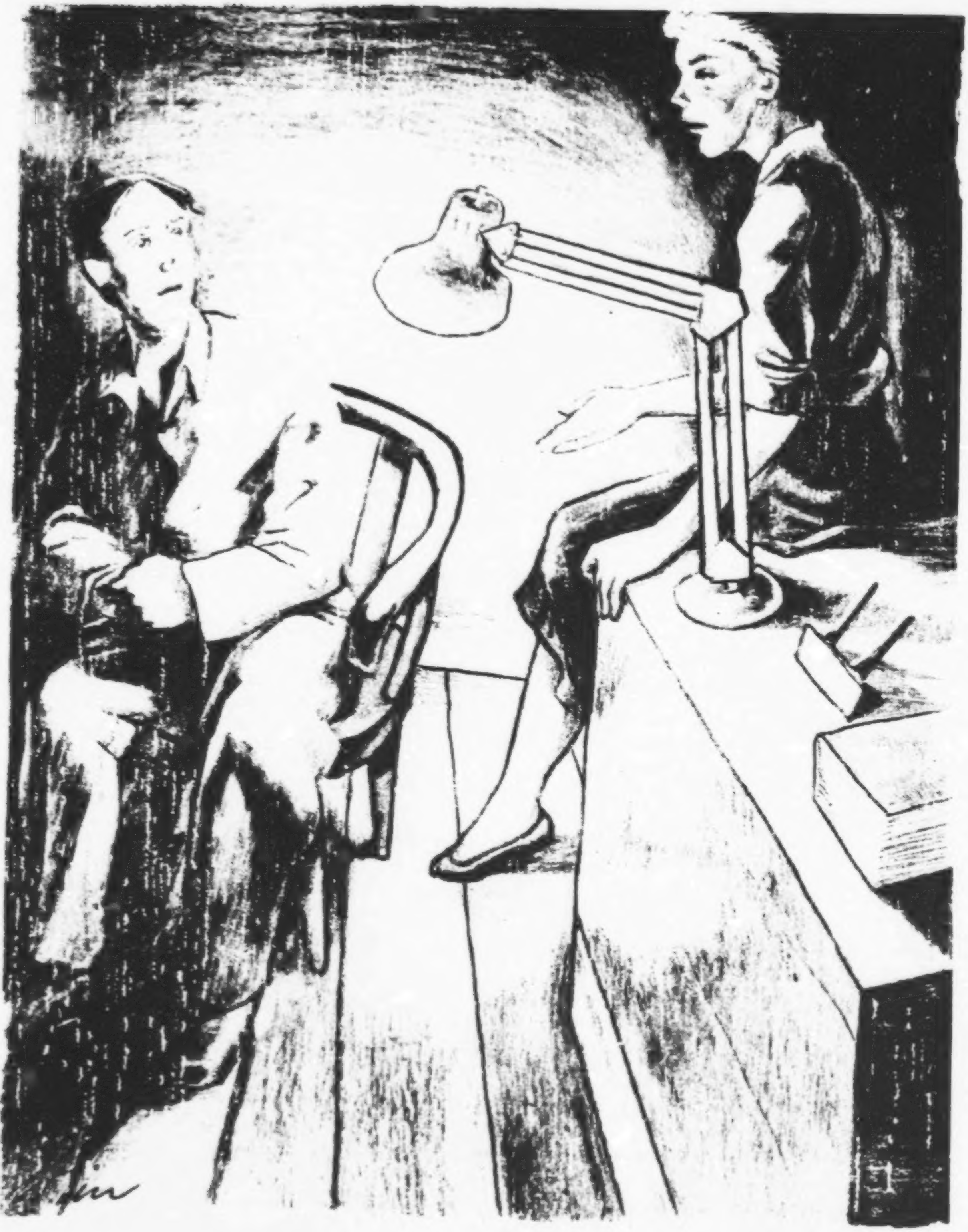
F-92

Picture Number Five



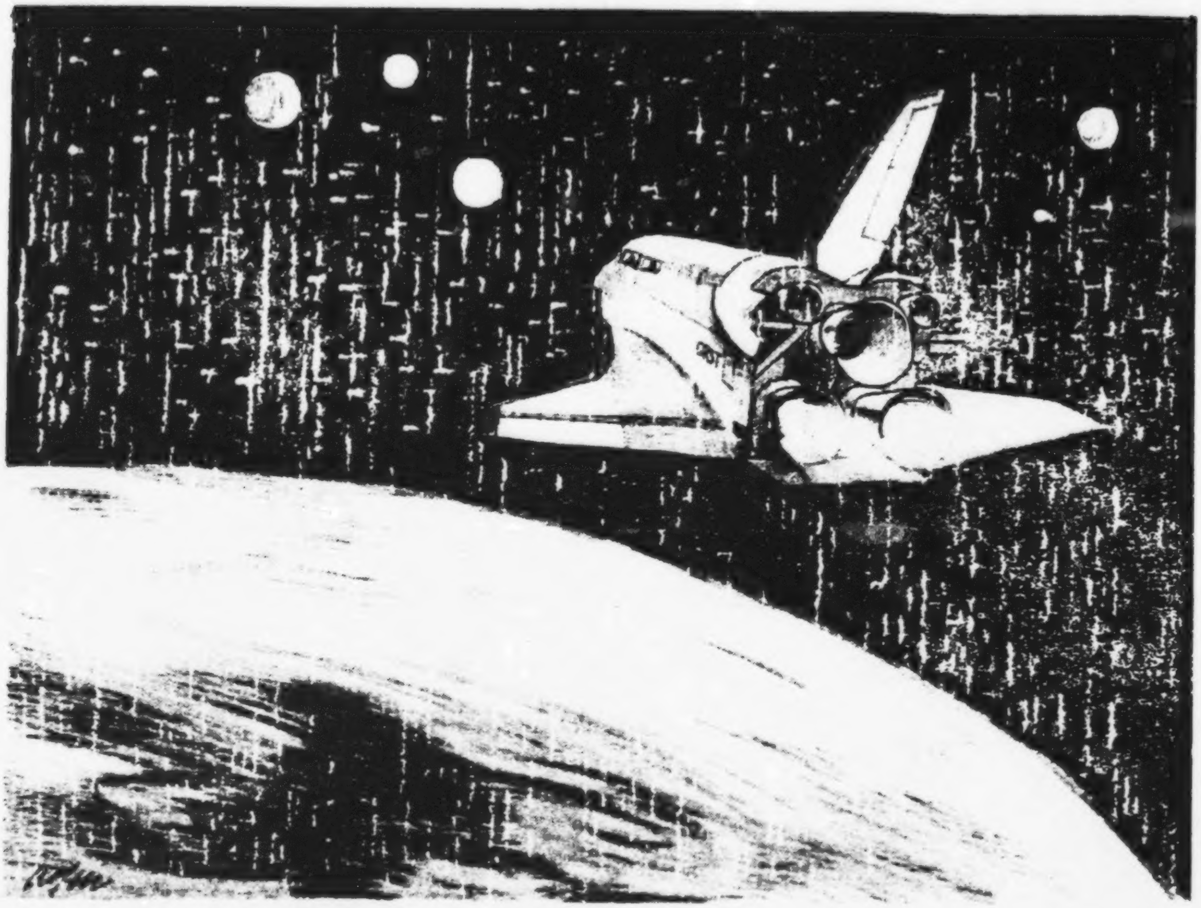
F-94

Picture Number Six



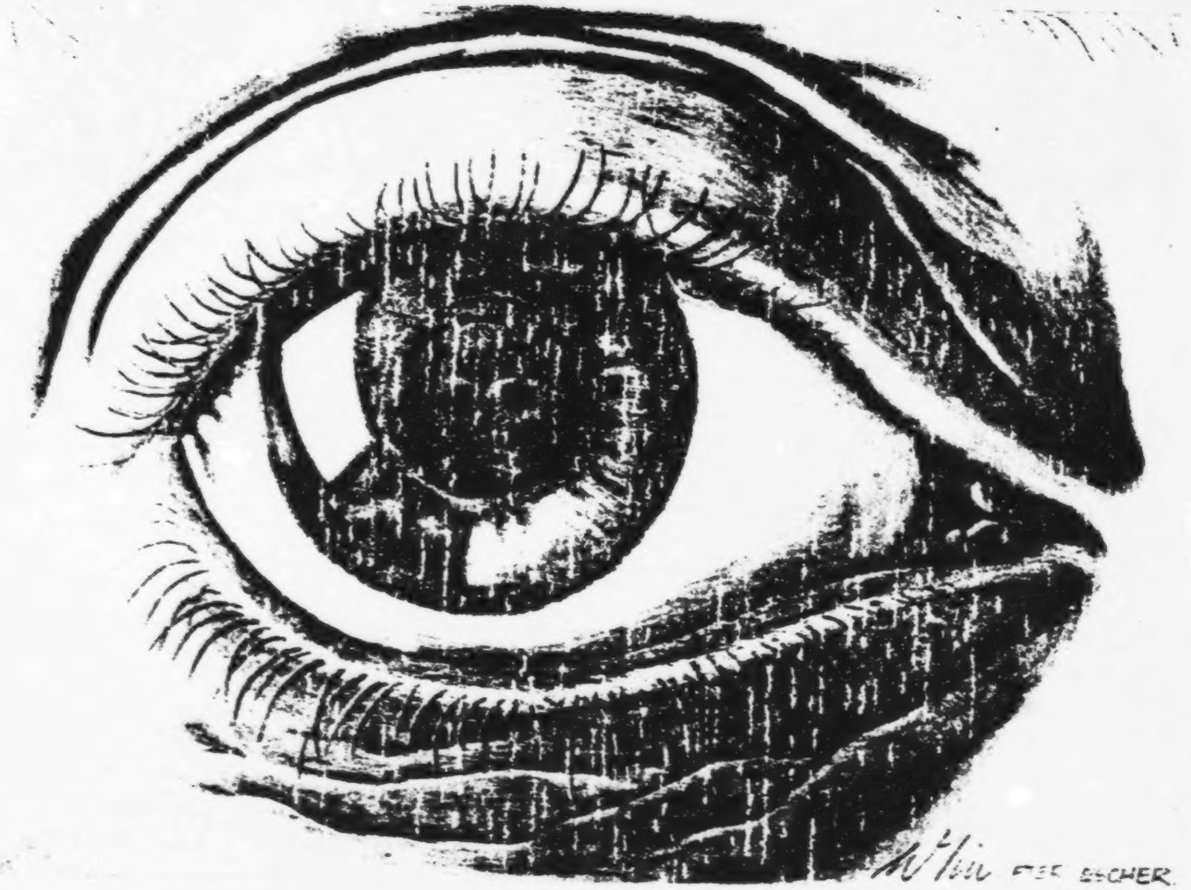
F-96

Picture Number Seven



F-98

Picture Number Eight



APPENDIX G

SELECTED RESOURCE GUIDE

SELECTED RESOURCE GUIDE

The resources listed were taken selectively from Presseisen (1987)

1. Published Programs for Thinking Skills Instruction

1.1. Instrumental Enrichment (Reuven Feuerstein).
Curriculum Development Associates
1211 Connecticut Avenue, N.W.
Suite 414
Washington, DC. 20036

also

Scott, Foresman and Company
Lifelong Learning Division
1900 East Lake Avenue
Glenview, IL 60025

1.2. Philosophy for Children (Matthew Lipman).
Institute for the Advancement of Philosophy for Children.
Montclair State College
Upper Montclair, NJ 07043

1.3. Strategic Reasoning
Innovative Sciences, Inc.
Park Square Station
P.O. Box 15129
Stamford, CT 06901

2. Resources That Emphasis Essential Thinking Skills

   2.1. Howard Black and Sandra Black, Building Thinking Skills, series
   (Pacific Grove, CA: Midwest Publications, 1984).
   Midwest Publications
   P.O. Box 448
   Pacific Grove, CA 93950-0448

   2.2. High Scope Resources for pre-school and primary grades.
   High/Scope Press
   600 North River Street
   Ypsilanti, MI 48198

   2.3. Bryce B. Hudgins, Learning and Thinking (Itasca, IL: F.E.Peacock, 1977).

3. Resources That Emphasize Complex Thinking Skills

   3.1. Cognitive levels and Matching Project
   Dr. Martin Brooks
   Shoreham-Wading River School District
   Shoreham, NY 11786

   3.2. Raymond S. Nickerson et al., Odyssey: A Curriculum for Thinking (Watertown, MA: Mastery Education, 1986)
   Mastery Education
   85 Main Street
   Watertown, MA 02172

   3.3. Arthur Whimbey, Analytical Reading and Reasoning (Stanford, CT: Innovative Science, 1983).

4. Resources That Emphasize Metacognitive Thinking Skills

   4.1. Joseph D. Novak and D. Bob Gowin, Learning How to Learn (New York: Cambridge University Press, 1985)

   4.2. D. Ray Reutzel, "Story Maps Improve Comprehension," The Reading Teacher 38(1985): 400-404.

   4.3. Steven R. Yussen, ed., The Growth of Reflection in Children (New York: Academic Press, 1985).

5. Resources That Elaborate Problem Solving

   5.1. Linda J. Sheffield, Problem Solving in Math (New York: Scholastic Skill Books, 1982).

5.2. Franette Walberg, Puzzle Thinking (Philadelphia: Franklin Institute Press, 1980).

5.3. Arthur Whimbey and Jack Lochhead, Problem Solving and Comprehension (Philadephia: Franklin Institute Press, 1982).

6. Resources That Elaborate Decision Making

6.1. Diane Draze, OPTIONS: A Guide for Creative Decision Making (San Luis Obispo, CA: Dandy Lion Publications, 1982).

6.2. Micki McKisson, Chrysalis: Nurturing Creative and Independent Thought in Children (Tuscon, AZ: Zephyr Press Learning Materials, 1983).
Zephyr Press Learning Materials
430 S. Essex Lane
Tucson, AZ 85711

6.3. Judy Rierson and Mary Claiborne, Extending Thinking Abilities, NO.8112 (Buffalo, NY: D.O.K. Publishers, n.d.)
D.O.K. Publishers
71 Radcliff Road
Buffalo, NY 14213

7. Resources That Elaborate Critical Thinking

7.1. Diane F. Halpern, Thought and Knowledge: An Introduction to Critical Thinking (Hillsdale, NJ: Lawrence Erlbaum Associates, 1984)

7.2. Anita Harnadak, Critical Thinking, series (Pacific Grove, CA: Midwest Publications, 1976).

7.3. John E. McPeck, Critical Thinking and Education (Oxford, England: Martin Robertson and Company, 1981).

8. Resources That Elaborate Creative Thinking

8.1. Books that illustrate using language creatively such as: Marvin Terban, Eight Ate: A Feast of Homonym Riddles (New York: Clarion Books, 1982).
Marvin Terban, In a Pickle: And Other Funny Idioms (New York: Clarion Books, 1983).

8.2. CoRT Materials, Edward deBono, Cognitive Research Trust.
Pergamon Press
Fairview Park
Elmsford, NY 10523.

8.3. Sam Epstein and Beryl Epstein, The First Book of Codes and Ciphers, 1956.
Franlin Watts, Inc.
875 Lexington Avenue
New York, NY 10022.

9. Resources That Apply Thinking to Language Arts

9.1. John N. Hays et al., The Writer's Mind: Writing as a Mode of Thinking (Urbana, IL: National Council of Teachers of English, 1985).

9.2. Charles Suhor, "Thinking Skills in the English Language Arts," Problem Solving 5 (1983): 1-4.

9.3. Twist-A-Plot Books
Scholastic, Inc.
730 Broadway
New York, NY 10003.

10. Resources That Apply Thinking to Mathematics

10.1. Sun Jun Pai and Hang Young Pai, Chisanbop: Original Finger Calculation (New York, NY: American Book Company, 1984).
American Book Comany
135 W. 50 Street
New York, NY 10020.

10.2. Nuffield Mathematics Project
John Wiley and Sons, Inc.
605 Third Avenue
New York, NY 10158.

10.3. Steven S. Willoughby et al., Real Math (LaSalle, IL: Open Court Mathematics and Science, 1985).
Open Court Publishing Company
P.O. Box 599
Pern, IL 61354-0599.

11. Resources That Apply Thinking to Social Studies

11.1. Catherine Cornbleth, Critical Thinking and Cognitive Process, in Review of Research in Social Studies Education 1976-1983, bulletin 75 (1983), 11-63.

11.2. Maps, documents, vocabulary, writing, tests.
Educational Masterprints Company
Box 269
Garden City, Long Island
New York, NY 11530.

11.3. Jamieson McKenzie, "In Search of a Scope and Sequence for Social Studies," Social Education 48 (1984): 249-261.

12. Resources That Apply Thinking to Science

12.1. Arnold B. Arons, "Computer-Based Instructional Dialogues in Science Courses," Science 224 (1984): 1056.

12.2. Anton E. Lawson, "Investigating and Applying Developmental Psychology in the Science Classroom," in Learning and Motivation in the Classroom, Scott Paris, Gary M. Olson, Harold W. Stevenson, eds. (Hillsdale, NJ: Lawrence Erlbaum, 1983), 113-135.

12.3. Lawrence A. Stevens, Thinking Tools: A Young Person's Guide to Problem Solving (Stockton, CA: Stevens and Shea Publishers, n.d.).
Stevens and Shea Publishers
325 E. Wyandotte Street
Stockton, CA 95204.

13. Resources That Apply Thinking to the Arts

13.1. Betty Edwards, Drawing on the Right Side of the Brain (Los Angeles: J.P.Tarcher, Inc., distributed by Houghton Mifflin Company, 1979).

13.2. Laura Chapman, Discover Art, series (Worchester, MA: Davis Publications, 1985).

13.3. Jon J. Murray, "Art, Creativity, and the Quality of Education," Independent School 43 (1984): 23-27, 60-66.

13.4. Mona Brookes, Drawing with Children (Los Angeles: J.P.Tarcher, Inc., distributed by St. Marthin's Press, 1986).

14. Resources That Apply Thinking to Computer Science

14.1. Beverly Hunter, My Students Use Computers: Learning Activities for Computer Literacy (Reston, VA: Reston Publishing Company, 1983).

14.2. Peter H. Martorella, "Interactive Video Systems in the Classroom," Social Education 47 (1983): 325-327.

14.3. Writing to Read System.
International Business Machines
IBM Building - Room 600 A & B
100 E. Pratt Street
Baltimore, MD 21202

15. Teacher Planning Materials for Curriculum and Instruction

15.1. Hans G. Furth and Harry Wachs, Thinking Goes to School: Piaget's Theory in Practice (New York: Oxford University Press, 1974).

15.2. ASCD Resource Materials and Study Institutes (print, audio, and video materials).
Association for Supervision and Curriculum Development
125 North West Street
Alexandria, VA 22314.

15.3. ASCD Thinking Skills Network (newletter and directory).
Dr. John Barell
210 Chapin Hall
Montclair State College
Upper Montclair, NJ 07043.

According to Presseisen (1987) the following questions should be asked when examining programs and materials for potential use:

1. Is the program based on a theoretical model?

2. What thinking skills are identified, developed and evaulated by the program?

3. Are the identified thinking skills explicitly taught or are they imbedded within the curriculum?

4. What is the target population of the program (grade level, subject area, ability level)?

5. What is the teacher's role in implementing the program? What instructional methods are employed?

6. What instructional materials are required? What supplementary materials are available?

7. What are the teacher training requirements? Are training services available?

8. What are the implementation and maintenance costs for the program? What are the per pupil costs?

9. How has the program been evaluated? What is the evidence of its effectiveness?

10. Is the program being conducted at a nearby school? What is the name of a contact person who could answer questions and/or arrange for an observation visit?